ANFA
The Academy of Neuroscience for Architecture

SHARED BEHAVIORAL OUTCOMES
PRESENTED POSTERS

SEPTEMBER 20-22, 2018
SALK INSTITUTE

Contributed Posters #1
Thursday, September 20th | 2:45 – 4:00 PM

Marina Russo-Schtcherbakoff-Kodakoff, RSK Architects / Toulon – France
Measuring the Impact of the Building (Interior/Exterior) on the User's Brain and Behavior

Richard Buday, Archimage / Houston, Texas
Behavior-Aided Design: A Translational Approach

Bianca Predoi, BPArchitecture / Belgium
NTA, Neuro Test for Architecture

Zhengbo Zou, New York University / New York, New York
How Does Visibility in Urban Settings Change Human Perception of Urban Design?

Kevin Bennett, Pennsylvania State University / Pennsylvania
Personality and Location Decision Making: Mapping the Distribution of Big Five Personality Traits inside Built Designs

Jennifer Shields, Cal Poly / San Luis Obispo, California
Comparing Physiological Responses to Modes of Spatial Representation

Arlene Ducao, NYU & MIT / New York, New York
Multimer: Human Signals for Improved Spatial Design

Rainer Gabriel, Gabriel / Düsseldorf
The Built Environment as Cultura (Emotion Generator & External Brain)

Gideon Spanjar & Frank Suurenbroek, Amsterdam University Of Applied Sciences / Amsterdam
(Eye)Tracking Users' Patterns: Visual Experience and Choice Behavior in Transition Zones of Amsterdam-Southeast

Andrea Jelic, Aalborg University / Aalborg
Using the Embodied Language of Space to Develop Stress Assessment Tool for Architectural Experience

Ann Sussman, ArtScape / Concord, Massachusetts
Using Biometric Software to Understand the Architectural Experience and Improve Design

Madlen Simon, University of Maryland / College Park, Maryland
EEG in a controlled virtual environment -Inform Design?

Sara Ebrahem / Alexandria, Egypt
Monitoring of User Experience in Controlled Spatial Environments: Bibliotheca Alexandrina as a Case Study

Matt Smith, University of San Diego California / San Diego, California
A Culture of Experimentation: From the Torrey Pines Living Lab to Emerging Neuro-Architecture Lab

Behavior-aided Design: A Translational Approach to Persuasive Architecture

Richard Buday, FAIA, Archimage, Inc. Houston, Texas
Tom Baranowski, PhD, Baylor College of Medicine Houston, Texas

Introduction: Architects strive to design functional and fashionable buildings, but they struggle with subjects beyond their expertise—such as anticipating and influencing how users respond to built environments. This knowledge gap is significant because the world's most serious design problems are behavioral,[1] not architectural—from climate change to crime to hunger to illiteracy to preventable death and disease. Architects' unfamiliarity with behavior science limits the profession's ability to create societally meaningful buildings. Even with the aid of psychologists and neuroscientists, though, the influence of buildings on users and communities is difficult to predict. It is prohibitive to construct a project, observe people's actions, conduct focus groups, analyze results, and then renovate or rebuild if the building doesn't perform as intended.

A combination of ancient and modern place-making technologies offers a solution. First are stories. Narratives have been shaping people's behavior since the dawn of humankind.[2] Humans are hardwired for stories, which deliver hi-fidelity learning experiences without the danger of trial and error (what doesn't kill you makes you stronger, but it *could* kill you). So important is narrative to civilization that, up until the Modern Movement, architecture was saturated with foundational metanarratives,[3] i.e., stories that provide structure for a society's beliefs. Pre-modern buildings were behavior change agents.

Second, games are a time-tested means of shaping behaviors, and particularly suited to training simulations.[4] Third, video games have grown into a medium that combines the power of storytelling with the skill-building experience of role-playing. Finally, architects' computer design tools are compatible with narrative-driven video game software. Thus, computer games are potential sandboxes to study and develop persuasive architecture—buildings designed to improve human behavior.

The investigators have undertaken substantial qualitative and quantitative research on behavior modification using storied virtual environments. Studies include video games and narratives that promote new behaviors,[5,6] emotional responses to simulated worlds and background narratives,[7] training behaviors, the use of prose fiction as narrative companions to virtual environments,[8] and adapting behavior-inducing worlds to a target population's needs. Based on twenty years' experience, we present opportunities to translate persuasive video game research into persuasive architectural design theory.

Background: Science suggests how, when, and why people modify what they think and do. Some of these psychosocial algorithms apply to architecture. Social Cognitive Theory (SCT) asserts environments and personal factors (some of which are under an architect's control) are interrelated with behavior (**Fig. 1**).[9] Self Determination Theory (SDT) argues intrinsic motivation (activities that are self-motivating because they are fun or exciting) is the most potent factor in behavior change.[10] Narrative Transportation Theory (NTT) describes story and game immersion as inherently fun activities (and, therefore, self-motivating).[11] NTT is supported by Theory of Mind (ToM), which reflects people's innate ability to read others' mental states. The Theory of Planned Behavior (TPB) posits people's actions are products of perceived subjective norms,[12] which can be portrayed in stories and games and encouraged by architecture. The Transtheoretical Model (TTM) describes behavior modification as a sequential process that begins with changing minds and leads to new or modified behaviors (**Fig. 2**). These theories can scaffold into architectural experiences (**Fig. 3**).

Behavior-aided Design Methodology: A narrative-based building can be computationally pre-tested for behavioral impact (**Fig. 4**). During the schematic design phase (**Fig. 4a**), a three-dimensional model is created using common design software (e.g., SketchUp, Revit, AutoCAD, 3D Studio Max). The model is then imported into a video game engine such as Unreal or Unity 3D, and populated with artificially intelligent, anthropomorphic, non-player characters (NPCs) programmed to represent cross-sections of the building's intended population (i.e., age, gender, abilities, schedules, and goals). NPC simulations are run to identify traffic flow, herding behavior (the practice of unconsciously imitating what others do), and way-finding. Through multiple iterations, gaps and deficiencies in a building's behavioral performance are identified and design refinements made. In each cycle, machine learning allows NPCs to increase their knowledge about the environment, permitting them to react to conditions autonomously and ever more accurately.

During design development, the building's metanarrative is converted to prose (vignette, short story, novella, etc.) (**Fig 4b**). Story and building are then tested with actual building users, who navigate and interact with the proposed environment within the game engine using conventional screens, mouse, keyboard, gamepad, or augmented or virtual reality headsets. Test results refine building design development.

Discussion: Narrative immersion is a proven means of shaping behavior. Early architects understood the power of embedding stories in their buildings.[13] For example, the Parthenon's east elevation depicts the birth of Athens. The Parthenon in 430 BCE literally and literarily immersed visitors in a story about divine democracy, imparting and reinforcing Grecian society ideals and wisdom. Gameplay, once a purely physical activity, has grown into a massive digital industry, with video game sales now surpassing movie ticket and music sales.

Behavior scientists have recognized the value of combining story with spatial experiences in a genre of video games called "Games for Health" (**Fig. 5**).[14] Today's architecture has similarly been reborn digital, and its new life is bi-directional: virtual buildings mimic physical building experiences with increasing fidelity.

Although architects lost their persuasive skills during the Modern Era, the profession's newfound embrace of potentially persuasive technology offers opportunities for architecture to reclaim its historical role of transforming society. Turning architects' models into laboratories to test behavioral concepts during design may also spur new lines of interdisciplinary research between architecture, psychology, and neuroscience.

Example: *Mommio® Food Fight* is a first-person, role-playing, smartphone video game designed to improve the food parenting behaviors and skills of young mothers. The game is based on the romance novel, *Totally Frobisher*, which is part 2 of a three-book series. The Mommio game appears in each story as a plot device. The game itself incorporates free-roam virtual environments, such as a small house, residential neighborhood, family car, downtown environment with a grocery store and fast-food restaurant. Players take on the role of "Mom," who can free-roam throughout the game environments, all of which are interactive. For example, the home's kitchen is fully functional, with a working oven and stocked refrigerator. Characters portrayed in the story reappear as NPCs in the video game (Fig. 5).

Mommio was designed by architects working with a team of behavioral scientists, physicians, dietitians, video game developers, and creative writers. Environments were made in SketchUp and 3D Studio Max and imported into Project Anarchy (Havok/Intel, Santa Clara, CA) and Unreal Engine 4 (Epic Games, Inc., Cary, NC). [15]

Targeted to mothers of 3 to 5-year-old children, *Mommio* is a series of novels with plots linked to a video game.

Readers can navigate the story-based game world and interact with NPCs and the built environment.

AI-driven NPCs self-navigate, respond to personal goals, and changing environmental conditions.

NPCs respond to player input, self-navigate, responding to personal goals, and environmental conditions.

Figure 5. *Mommio® Food Fight* behavioral intervention (Archimage and Baylor College of Medicine)

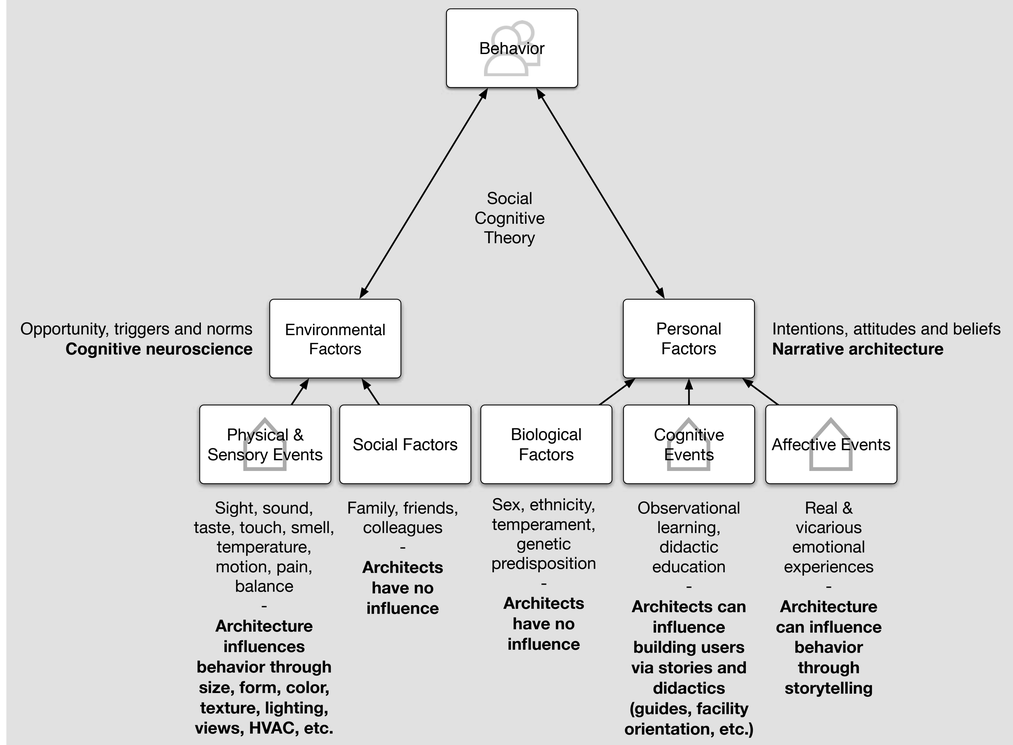

Figure 1. SCT applied to architectural design

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14 Baranowski, T., et al., *Playing for real: Video games and stories for health-related behavior change.* American Journal of Preventive Medicine, 2008. 34: p. 74.
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Portions of this research was made possible in part by SBIR funding from the US Eunice Kennedy Shriver National Institute of Child Health and Human Development by grant R44HD075521.

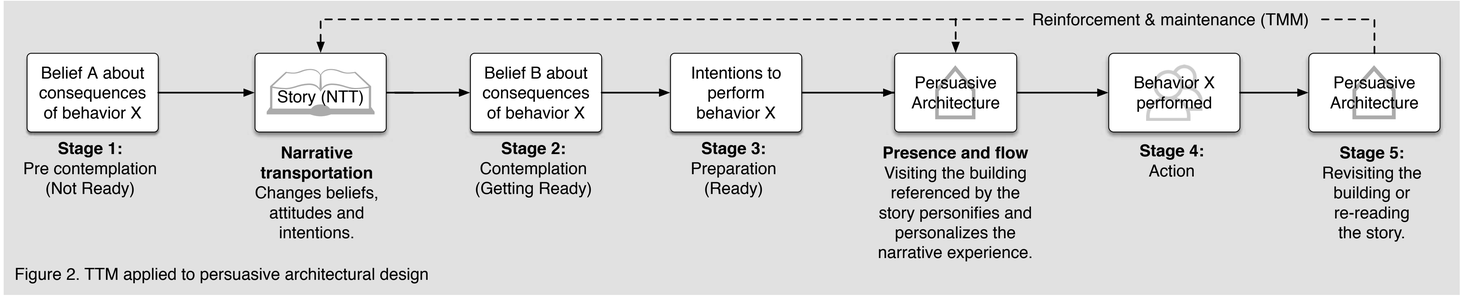

Figure 2. TTM applied to persuasive architectural design

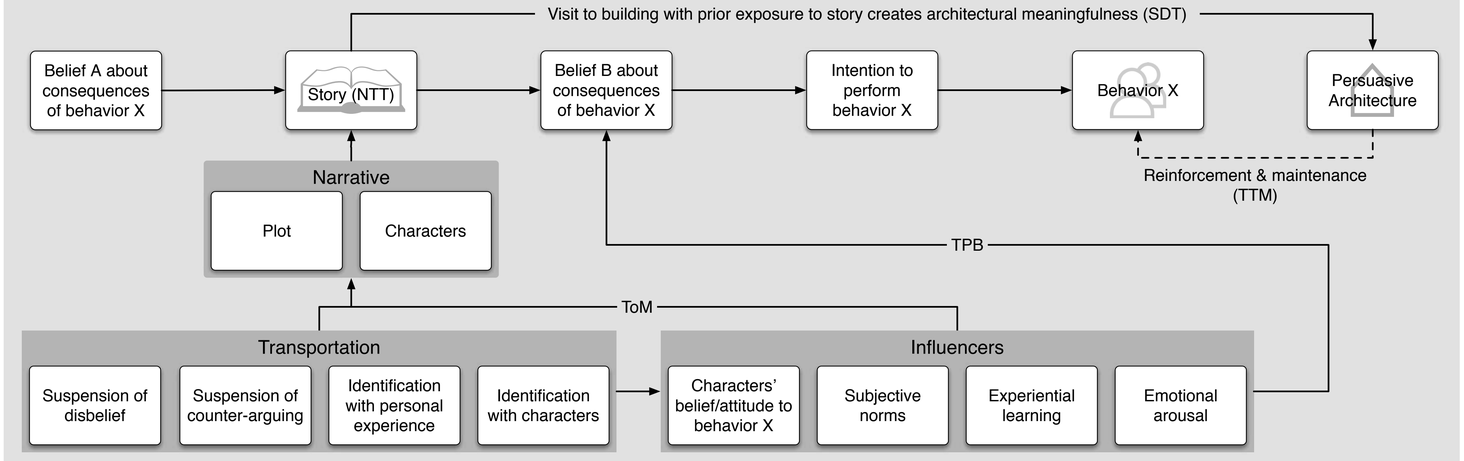

Figure 3. SDT, NTT, TPB, and ToM applied to persuasive architectural design

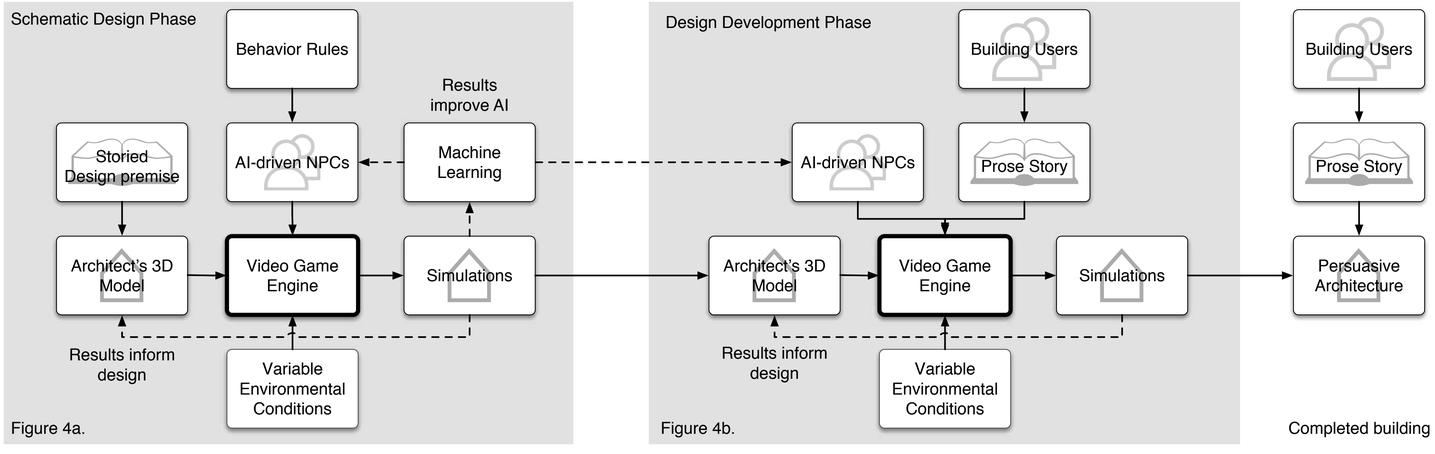

Figure 4a. Figure 4b. Completed building

Figure 4. Behavior-aided Design

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www.**Archimage**.com www.**Archimage-Press**.com Video game research publication list:

Personality and location decision making: Mapping the distribution of big five personality traits inside built designs

by Kevin Bennett, Ph.D.
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Pennsylvania State University, Beaver Campus
Academy of Neuroscience for Architecture, September 2016

Summary

For five semesters, students in the Introductory Psychology courses at Penn State Beaver were free to choose their seats each day in a medium-sized lecture hall classroom.

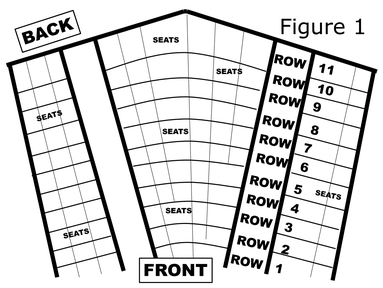
- The Openness factor (O) on the NEO-Five Factor Inventory was the best predictor of Exam Scores.
- Front Rows showed higher scores on 2 personality factors: Openness (O) and Conscientiousness (C).
- Female students and older students were significantly more likely to sit near the front.

The Big Question: When you enter an empty auditorium where do you want to sit and why?

Method

Seating preferences were established quickly and remained stable throughout the semester. One month into the course, following the first exam, students (N=237) were given several personality measures while seating locations by row were recorded (see Figure 1).

Figure 1



Sample Items from the NEO-FFI

Neuroticism (N)
I often feel tense and jittery.

Extraversion (E)
I really enjoy talking to people.

Openness (O)
I am intrigued by the patterns I find in art and nature.

Agreeableness (A)
I generally try to be thoughtful and considerate.

Conscientiousness (C)
I work hard to accomplish my goals.

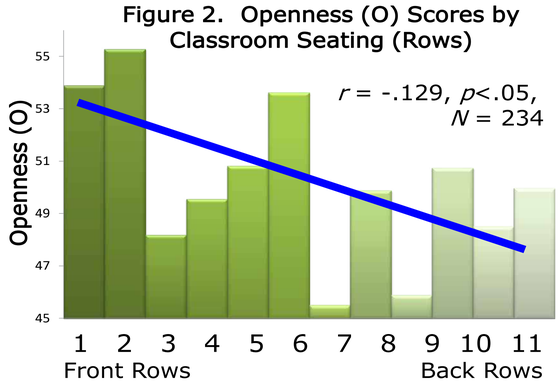
The NEO-Five Factor Inventory (NEO-FFI) was developed as a short form of the NEO PI-R (Costa & McCrae, 1985).

Using a 5-point scale for each question, this test consists of 60 items that measure five domains of personality: Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness.

Results and Discussion

Openness (O) was highly correlated with Exam Scores (r = .276, p<.001, N=202). High O scorers were likely to receive high exam grades.

Figure 2. Openness (O) Scores by Classroom Seating (Rows)



Results indicated a significant correlation between Openness scores and seat preference with high O scorers sitting in the front rows (see Figure 2).

Figure 3 shows the results of an ANOVA test of Conscientiousness (C) between three groups of rows (front, middle, and back).

Students with high factor Cscores were more likely to choose seats in the first four rows.

Figure 3. Conscientiousness (C) by Classroom Seating (Rows)

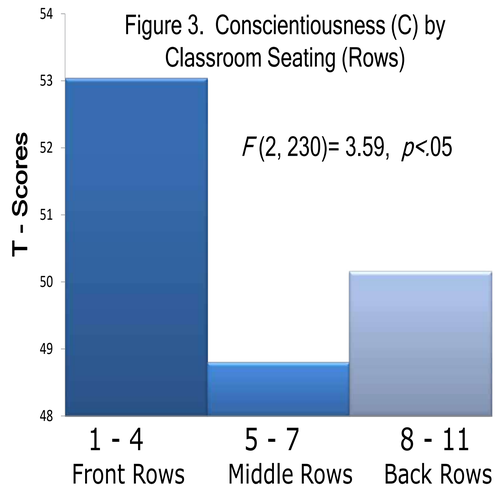
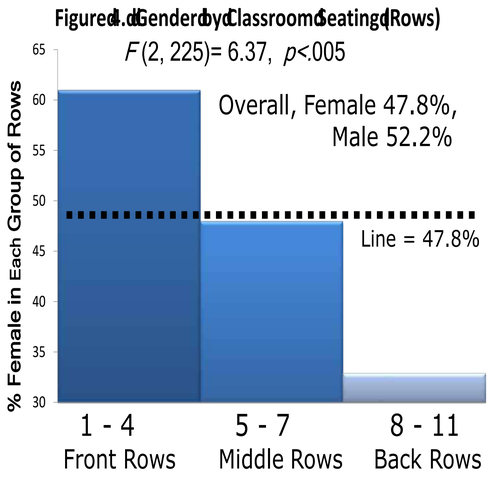


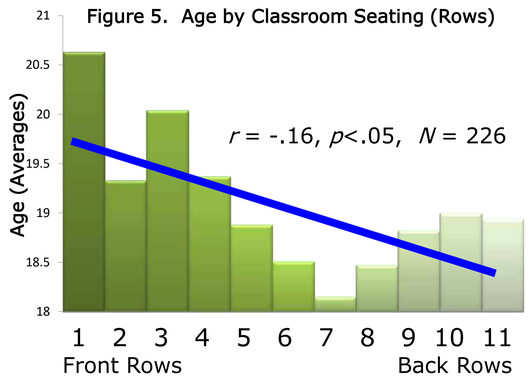
Figure 4. Gender by Classroom Seating (Rows)



The distribution of students was influenced by gender and age (see Figures 4 and 5, respectively).

Female students and older students were more likely to occupy seats near the front of the class.

Figure 5. Age by Classroom Seating (Rows)



Although not significant, it is worth noting that the Middle Rows showed higher scores on the Neuroticism factor (N) and Front Rows showed higher scores on the Agreeableness Factor (A) (see Figure 6).

Finally, the correlation between Exam Scores and Row was in the anticipated direction (i.e., better scores in the front) but did not reach significance. (r = -.109, p<.15, N=203).

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COMPARING PHYSIOLOGICAL RESPONSES TO MODES OF SPATIAL REPRESENTATION

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MARRIAGE AND FAMILY THERAPIST, SANTA BARBARA, CA

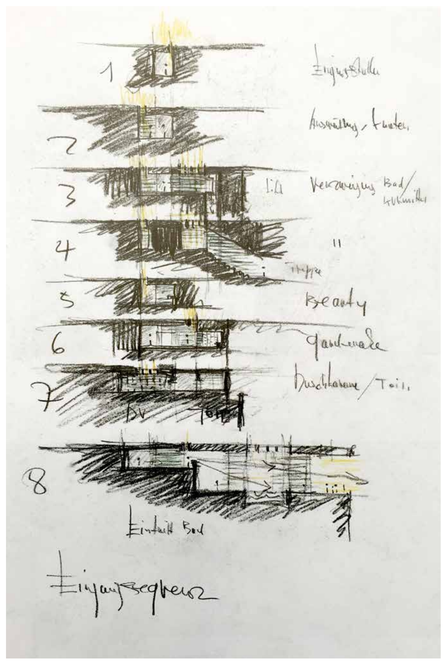
BACKGROUND

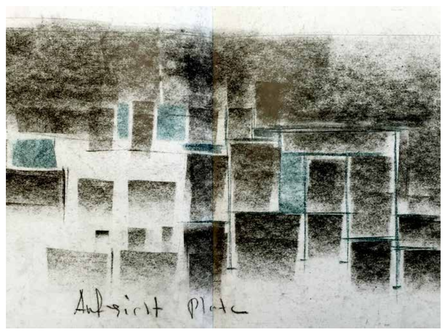
Architects design with a range of 2D modalities including rough sketches, precise line drawings, and renderings from digital models. The resulting built works are new configurations of spaces and forms, which humans respond to physiologically. But how does the built work compare with its earlier representations? This project aims to relate physiological responses in the embodied experience of the built space with the responses evoked when looking at architectural representations. Our research questions include: Do viewers consistently respond, physiologically, to the same modalities?
Can physiological responses to a drawing predict responses to the built space?

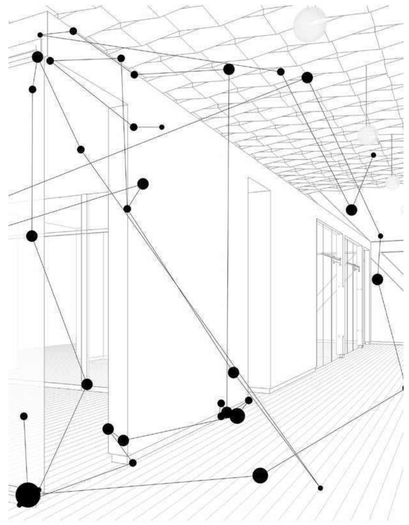
THE TREACHERY OF IMAGES (THIS IS NOT A PIPE)
RENE MAGRITTE, 1929

"The image is not to be confused with something tangible: The image of a pipe is not a pipe."

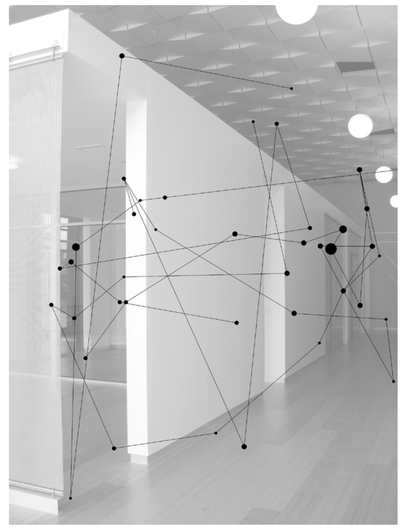
-Rene Magritte 1961



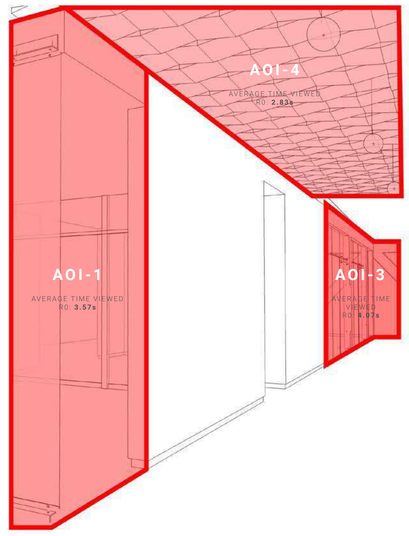




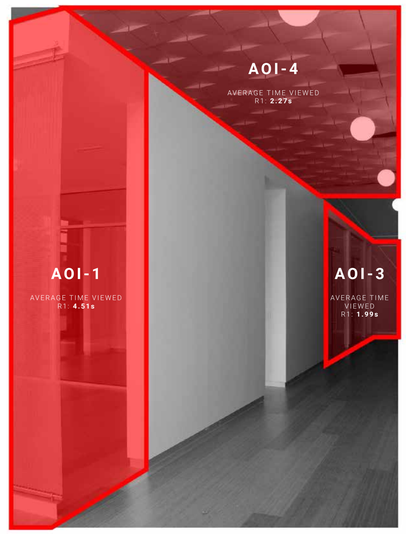
EXAMPLE: SCAN PATH AND FIXATIONS R0



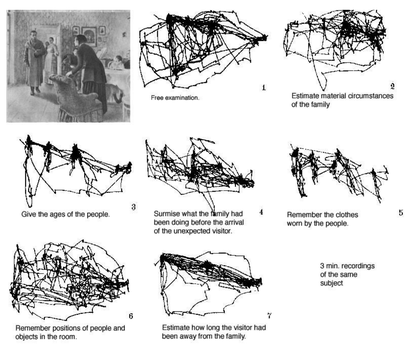
EXAMPLE: SCAN PATH AND FIXATIONS R1



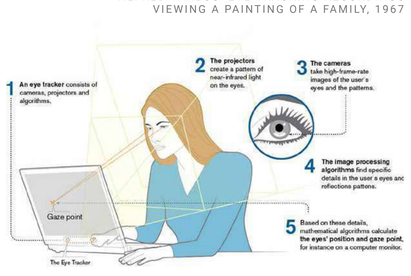
SELECT AREAS OF INTEREST R0



SELECT AREAS OF INTEREST R1



ALFRED YARBUS' EYE TRACKING RECORDINGS
VIEWING A PAINTING OF A FAMILY, 1967



TOBII EYE TRACKING EXPERIMENT SETUP

EMOTIV EPOC EEG DEVICE

METHODOLOGY

This project has produced two pilot studies investigating the relationship between 2D representations of 3D space and physiological response. Building on the research paradigm of Scene Perception (Rensink, 2000), researchers have been interested in how designers look at scenes. Experiments typically present the scene on a computer screen, allowing for a high level of control over variables of the scene (Holmqvist, 2011). Our initial pilot studies follow this methodology. Our first pilot study was a comparative study, in which architecture students at UNC-Charlotte and Harbin University in China were asked to look at two modalities of representation: a perspectival line drawing and a photograph of the built space. Optical tracking recorded eye movement. A second pilot study attempted to replicate this with architecture students at Cal Poly, and collected EEG data in addition to eye tracking data.

OUTCOMES

Results suggest that there are statistically significant differences in how the spaces are looked at in a drawing as compared with a photograph. Results from both pilot studies show that participants spent more time looking at the area of the drawing with the greatest graphical complexity (density of linework), while they spent more time looking at the area of the photograph with the greatest spatial complexity. This study helped us to determine the equipment appropriate for data collection, and to develop a protocol for both the study and the data analysis, utilizing a MANOVA method.

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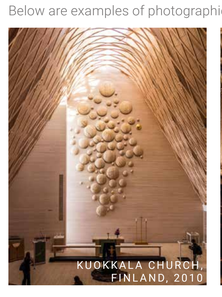
FURTHER RESEARCH

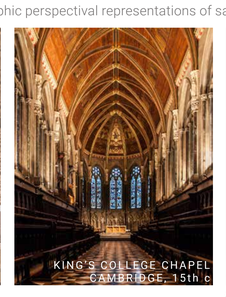
We will be conducting an expanded study where we will attempt to answer the following questions: What role does architecture play in experiences of awe and wonder? Is it the quality of light, the materiality, the scale, or the embedded meaning in a work of architecture that elicits powerful responses? What is the physiological difference between physical immersion in a space and it's visual representation?

To find answers, a two-part study will be conducted: the first, a lab study whereby participants are shown photographs of a variety of sacred spaces, and the second, a field study where participants are fully immersed at the site of a sacred space. In both studies, we will be collecting psychophysiological data from a portable EEG, eye-tracking hardware, electro-dermal conductance, and heart-rate variability hardware. By analyzing the psychophysiological effects of viewing and experiencing sacred spaces, we can identify architectural factors that contribute to experiences of awe and wonder as distinct from (and independent of) cultural or religious associations.

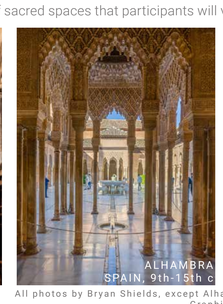
Below are examples of photographic perspectival representations of sacred spaces that participants will view while we measure responses.



KUOKKALA CHURCH, FINLAND, 2010



KING'S COLLEGE CHAPEL CAMBRIDGE, 15th c



ALHAMBRA SPAIN, 9th-15th c

CARMO CONVENT LISBON, 1389

All photos by Bryan Shields, except Alhambra, by wanderlustgranadatours.com.
Graphic design of this poster by Wood Cheng.

The built environment as cultural emotion generator and external brain

Tramsmission in Rhetorics, Arts & Cultural Evolution, is looking for neuroscientific proof of cultural evolution since 2003 and is currently located at the University of Wuppertal.

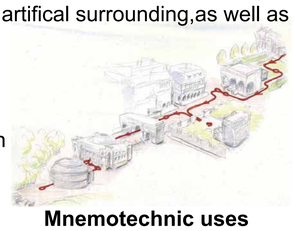
BERGISCHE UNIVERSITÄT WUPPERTAL

This poster was written by T.R.A.C.E. member Rainer Gabriel, designer, backed by his fellow research group members Heiner Mühlmann, Nico Pezer& Thomas Grunwald.

Introduction: Are we sensing culture?

Newer evolution-biologistic models suggest that culture has had an influence on our development. It seems quite possible that our built enviroment, architecture, is a product of a co-evolution between man and culture. Cultural artifacts might very well be developed for orientation in the new artifical surrounding,as well as it guides us through culture itself.

In the western culture one might assume, that it was a certain unit of form and content, best described by Vitruvs and Albertis decorum design rules, that imprinted cultural meanings into the artifacts for a couple of 1000 years.Theories of rhetoric and architecture suggest that buildings designed to be high ranking, according to the Western architectural decorum, have more impact on the minds of their beholders than low-ranking buildings.

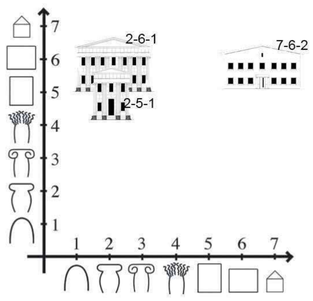


Mnemotechnic uses architecture for a reason

If that is the case, there has to be some kind of trace!
Some kind of neuronal adaptation that reacts when culturally stimulated.

Method: Reverse-reverse-engineering

The research group T.R.A.C.E. used event-related potentials in a visual object categorization task to probe this assumption and to examine whether the hippocampus contributes to the processing of architectural ranking *(Oppenheim et al)*.



Stimuli-development-system

The two groups of stimuli which were needed for the experiments consist of architectural sketches of high- and low-ranking buildings.

Drawing by cultural rules, gained by „reverse-engineering“

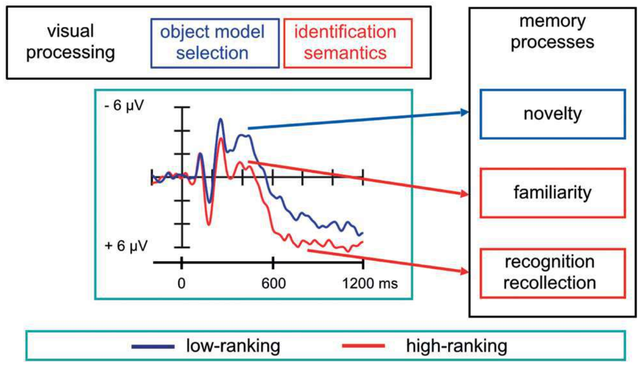
To avoid recall of existing buildings the stimuli are fast drawn freehand sketches that not try to copy real buildings but show fairly unrecognizable buildings, drawn according to the decorum rules.

The „buildings“ were generated by repeatedly projecting different design features onto certain basic shapes. The ranking of the basic shapes follows roughly Albertis suggestions and the develpment trough time itself:
Gate, order of columns, rising sacral building, horizontal palazzo, private house.

Examples: High-ranking buildings, refernce item, low-ranking building

Results: Generating familarity & novelty!

The neurophysical correlat of architectural stimuli perception gained by the experiments, shows a significant difference between the two classes of stimuli.



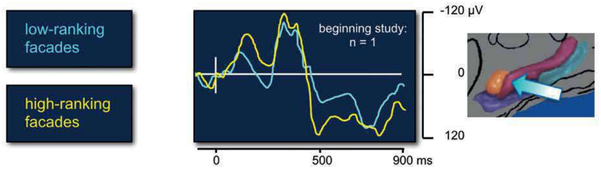
It was found that early negative potentials between 200 and 400 ms differentiated between high- and low-ranking buildings in healthy subjects and patients with temporal lope epilepsy with and without hippocampal sclerosis. By contrast, late positive potentials between 400 and 600 ms were higher in amplitude to high-ranking buildings only in healthy subjects and TLE patients without but not in TLE patients with hippocampal sclerosis.

Discussion: „And when I get that feeling, I want cultural healing“

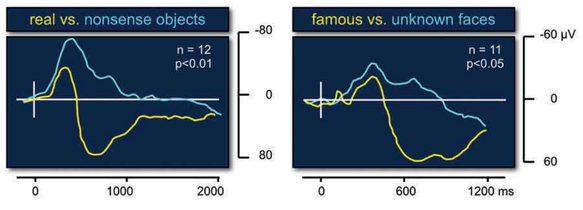
These findings suggest that the differentiation between high- and low-ranking buildings entails both early visual object selection and late post-model selection processes and that the hippocampus proper contributes critically to this second stage of visual object categorizations.

Based on this outcome it can be suggested that high-ranking-architecture causes familiarity effects within a viewer.At least if heritage spawns in Europe. Following this assumption architectural perception evokes different emotional responses depending on its position inside a cultural/archtectural ranking.

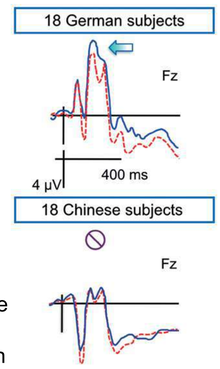
Comparing architecture, reality & celebraties.



It seems that culture allows the individual emotional access to his population. An emotional home for the social being that we are.



While the brain electrical responses of western test participants did differentiate between western decorum styled high- and low-ranking buildings both at an earlier and a later stage of visual processing, this difference was not found during the earlier stage when the experiment was repeated in a different cultural surrounding, namely Bejing, with asian participants *(Mecklinger et al)*.
Therefore it seems legitim to speculate that brain electrical responses to architectural ranking may be influenced by mental modular processes that were influenced by the cultural rule-system which is responsible for the outer appearance (facade design) of buildings.
The connection between form and emotion would function as a transgenerational, artificial emotion memory, that supports the fitness of a population by coordinating cultural tasks and helps to navigate trough an artificial landscape.

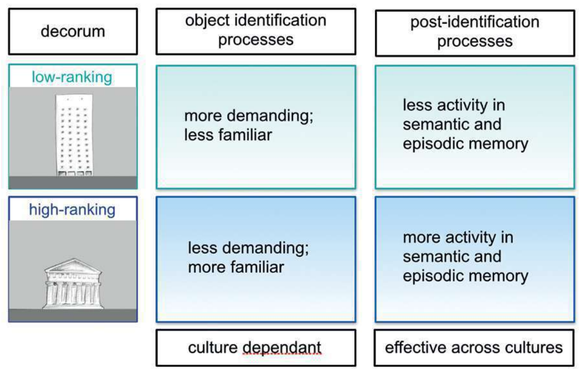


Conclusion: Reactivate the external brain

With significant differences between the outer design of high-ranking buildings from different cultures and being given that all of those buildings represent a highly relevant cultural value for the particular population over centuries, differences between the brain electrical responses of the cultural populations could be possible.

If this would be the case, working with those different responses might help to strengthen the cross-cultural dialogue as well as it might help architects and designers to activate a „forgotten/hidden“ pathway to memory enhancing cultural mental modular processes that are triggered by the shapes and rules of cultural artifacts.

But wether you try to avoid a clash of cultures or fight dementia, you should not ignore the traces left by a couple of 1000 years of cultural evolution and the emotions they are able to evoke.



Next: Different culture, same problem?

Now it is of significant interest to get to know architectural ranking systems from different cultures to be able to experiment if participants distinguish between those High- and Low-Ranking buildings too.

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(EYE)TRACKING USERS' PATTERNS:

VISUAL EXPERIENCE AND CHOICE BEHAVIOR IN TRANSITION ZONES OF AMSTERDAM-SOUTHEAST

ABSTRACT

Over the next 10 years, the City of Amsterdam plans to develop major housing schemes to provide 90,000 new homes within the existing urban fabric. At the same time, an urban renewal program is being launched to revitalize the most deprived neighbourhoods. Together, these challenges call for more evidence based design-principles to secure liveable places. Recent development in neuroscience, provides innovative tools to examine in a measurable, cause effect way, the relationships between the physical fabric, users' (visual) experience and their behavior in public spaces. In neuroscience, eye-tracking technology (ET) complements brain and behavioral measures (for overview see Eckstein et al. 2017). ET is already used to evaluate the spatial orienting of attention, behavioral response and emotional and cognitive impact in neuroscience, psychology and market research (Popa et al. 2015). ET may also radically change the way we (re)design and thus, experience cities (Sita et al. 2016; Andreani 2017). Until now, eyetracking pilot studies collected eye fixation patterns of architecture using images in a lab-setting (Lebrun 2016).

In our research project Sensing Streetscapes, we take eye-tracking outdoors and explore the potential ET may offer for city design. In collaboration with the municipality of Amsterdam and the local community, the H-neighborhood is used as a single case study. The main focus for urban renewal lies in the "transition-spaces". They connect the neighborhood with the rapidly developing adjacent areas and are vital for improving the weak social-economic status. The commonly used design principles are validated (Alexander et al. 1977; Gehl 2011, 2014; Pallasmaa 2012) and the consistency of ET is tested, alongside (walk along) interviews and behavioral observations. In the next phase, the data will be analyzed by a panel of applied psychologists and urban designers.

The initial results provide valuable lessons for the use of eye-tracking in urban design research. For example, a visual pattern analysis offers more accurate images of the spatial key-elements that matters when moving through transition spaces. More sensory-based city design research is needed to gather a full understanding of the relationships between the configuration of space, users' (visual) experience, behavioral responses and in turn, perceptual decision making.

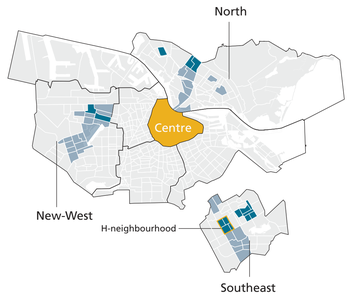


Fig.1 The 34 neighbourhoods designated for urban renewal in Amsterdam. AUAS active alongside action-research in three neighbourhoods including the H-neighbourhood in the Southeast.

CASE STUDY H-NEIGHBORHOOD

Fig. 2C Resolving barriers in the transition zones through technological, programmatic and spatial interventions, increase spatial cohesion and unlocks the urban renewal potential for the wider area.

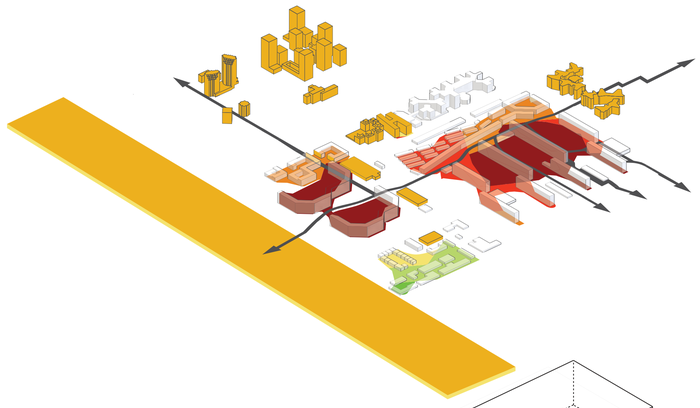


Fig. 2B The advanced existing network of footpaths (green) and planned redevelopment projects (yellow), offer potential to improve the poor quality of life conditions (in red).

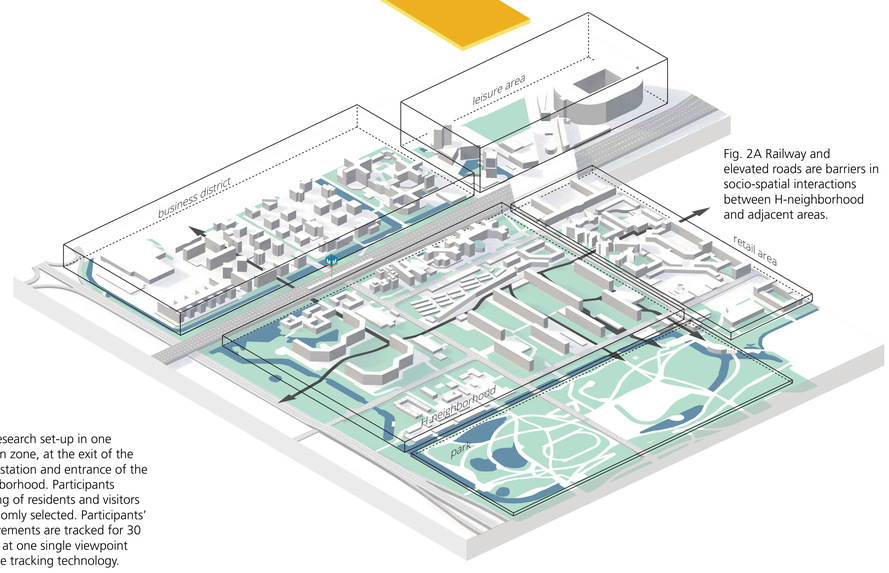


Fig. 2A Railway and elevated roads are barriers in socio-spatial interactions between H-neighborhood and adjacent areas.

TRANSITION ZONE

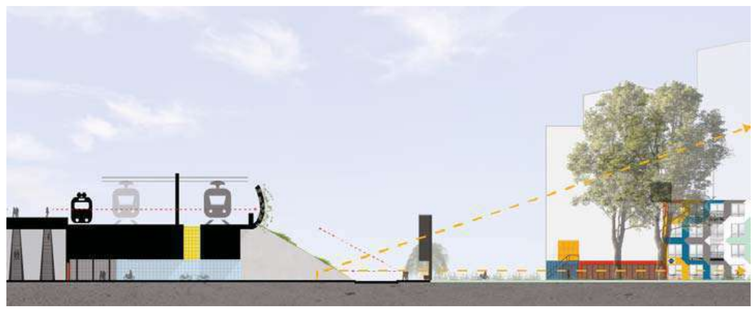
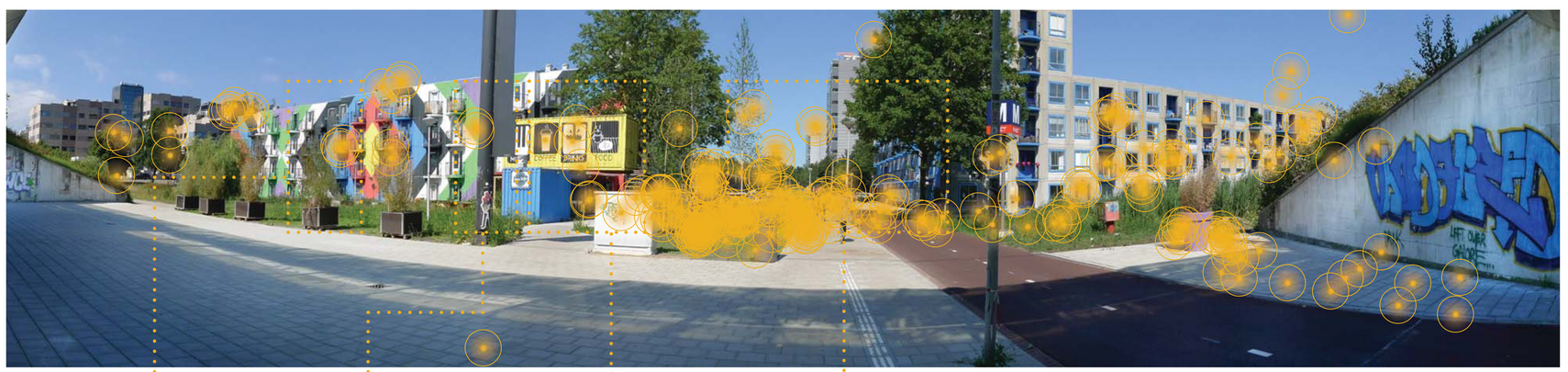


Fig. 3 Research set-up in one transition zone, at the exit of the subway station and entrance of the H-neighborhood. Participants consisting of residents and visitors are randomly selected. Participants' eye movements are tracked for 30 seconds at one single viewpoint using eye tracking technology.

USERS' VISUAL EXPERIENCE



PRELIMINARY FINDINGS

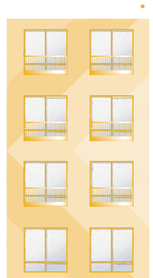


Fig. 3A Buildings with windows and in particular balconies, catch the eye.

Fig. 3B Interestingly, a large black flagpole shaped object was left unnoticed. One reason could be that the black colour worked as a blind spot due to the colourful buildings in the back-ground.

Fig. 3C The underpass to the coffee bar including the signboard above draws the attention of several participants.

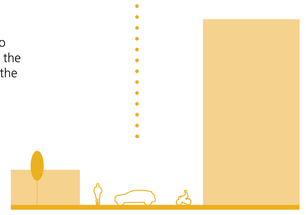


Fig. 3D Traffic such as pedestrians, cars and cyclists crossing the street deliver the most eye fixation.

NEXT STEP

Currently, the meta-data output consisting of eye patterns, behavioural responses and user perceptions, are analyzed by a panel of experts such as urban designers.

The research is taken forward to investigate opportunities to enhance human centred urban design through eye tracking research where urban densification continues.

Therefore, we are seeking for researchers from universities, research institutes and practitioners to join forces in this new field of research.

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Using the embodied language of space

to develop stress assessment tool for architectural experience

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I. Aim and the 3 foundational frameworks

The aim of the present project is to investigate **the link between the embodied reaction and aesthetic (conscious) experience of architectural spaces**, and the possibility of capturing this relation through a semantic rating scale, in order to assess the impact of architectural environments on people's stress response.

The expectations of the project are twofold: **1)** to test the advantage of using the embodied language of space in a questionnaire aiming to capture people's judgements of architectural environments and potential stress reaction; and **2)** to contribute to the broader need for developing methodological tools specifically aimed at addressing architectural questions in scientific context, in order to facilitate information exchange and usability of research results in architectural design.

I.1. Enactive approach and anticipatory aesthetics

Following the enactive-embodied cognition theory [1,2], the way in which humans perceive, experience, and engage with architecture depends on the particular kind of body we have and skillful action-oriented knowledge, which structures the possibilities for body-environment interactions. Accordingly, aesthetic experience of architecture is conceived as: **1)** being dependent and having its root in our **embodied interactions** with the built environment as a **socio-material landscape of affordances** [3,4]; and **2)** as an **evaluative process** that facilitates sense-making and **influences** the **anticipation** for agents' **interactions with the environment** [5].

I.2. Embodied language (of space)

A rich body of work within the fields of cognitive linguistics, semantics, and neuroscience on the role of embodiment in language emphasizes the **fundamental connection between linguistic meaning and range of embodied experiences (sensorimotor, affective, social)**, as well as mutual links between spatial language and spatial cognition [6–8]. The nature of language as embodied and situated indicates the crucial role of the environment – and thus potentially architecture – in acting as a scaffolding in language acquisition and understanding of linguistic meanings.

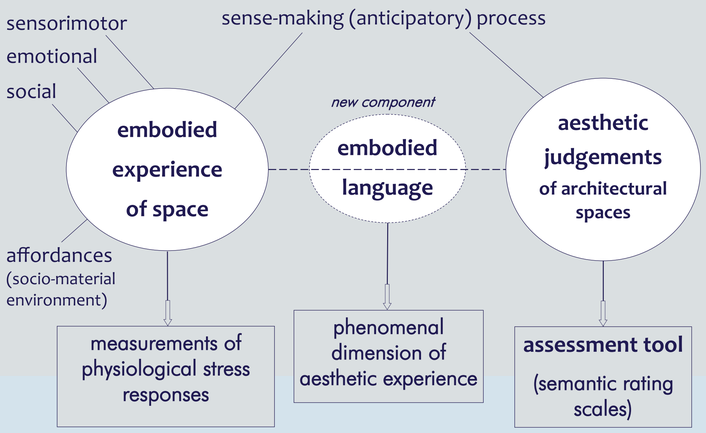
I.3. Küller's Semantic Environment Description

The Semantic Environment Description (SMB) was developed by architectural psychologists in 1970s in Sweden as a standardized tool (based on semantic rating scales) for systematic description of physical environments, later used as part of Küller's emotion-based model of environmental assessment [9]. They identified and validated 8 dimensions based on variety of factor analytical studies: *pleasantness, complexity, unity, enclosedness, potency, social status, affection,* and *originality*.

> "The dictionary will inform anyone who consults it that **the early use of words like *sweet* and *bitter* was** not to denote qualities of sense as such but to **discriminate things as favorable and hostile".**
>
> John Dewey (*Art as experience*, 1934, p.15)

II. Stress assessment tool: a hypothesis

- the enactive approach to aesthetic experience in architecture -



Following up on previous experimental studies by Fich et al. which showed that features of the spatial setting - presence or absence of openings in the room - influence participants' physiological stress reaction (measured as cortisol levels) [10] and the 3 theoretical frameworks outlined here, we hypothesize that:

1) the aesthetic experience of architecture is an **anticipatory process of making sense of a situation at hand** and hence, at least partially a kind of a **risk assessment process** which might **predict the physiological stress reaction in a given space;**

2) by virtue of experiential, embodied, and spatial grounding of linguistic meaning, it is possible to use this **space-body-language** relationship to obtain better targeted **descriptions of people's aesthetic judgements of spaces;**

III. Word selection methodology

The process of developing an assessment tool to capture and predict users' aesthetic experiences and their anticipated stress reaction in a specific architectural space, unfolds in 3 phases:

1) compiling a set of descriptive words (adjectives) in English and Danish following a system of selection criteria (see below);
2) testing the semantic scales based questionnaire in different environments, including virtual reality and real-world settings;
3) validating and refining obtained factor analysis results with physiological measurements and cross-linguistically.

III.1. Selection criteria and procedure

In contrast to similar existing tools designed to describe aesthetic experience and emotional impact of built environments, in this project particular emphasis is placed on the systematic selection of adjectives, following state-of-the-art ideas on embodied language: e.g., embodied metaphors, normative studies of abstract and concrete words, accounting in particular for psycholinguistic variables such as imageability, affectivity, multimodal and sensory experience properties [11,12].

Therefore, selection criteria and compiling procedure include:

1) compiling a larger initial set of adjectives (~400) in English from previous similar studies, from *Corpus of Contemporary American English* (COCA) and controlling for word frequency and common collocations with *space, environment, place, architecture, room* etc.
2) group of experts/researchers is asked to rate the words based on 6 criteria: to what extent does the adjective evokes or describes *spatial, emotional, and (multi-)sensory experience, (im)possible action or use in space, social situation or social atmosphere in space,* and *imageability/ concreteness.*

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Acknowledgements

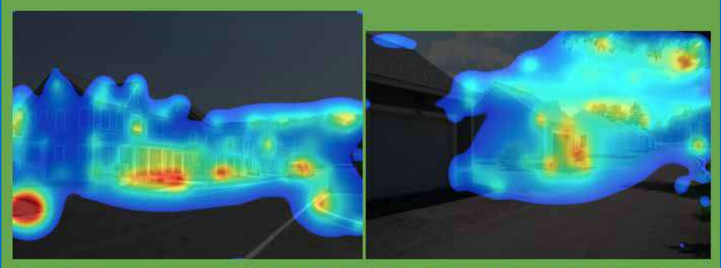
This project is supported by the Technical Faculty of IT and Design, Aalborg University, Denmark. The authors would like to thank Thorbjörn Laike for his helpful suggestions on the project setup and kind contribution to the word selection process.

Using Biometric Software to Understand the Architectural Experience and Improve Design

Justin B. Hollander, PhD, AICP, Ann Sussman, AIA, Hanna Carr, Tufts ‘20

This study used 3M’s Visual Attention Software (VAS) to measure the unconscious visual responses people have to houses and streetscapes. Results suggest new parameters for understanding the human experience of place and, more broadly, how biometric tools provide ways to predict our experience of architecture and can help designers build better places attuned to our nature.

The ‘regions’ that attract most attention in a scene are outlined showing their assigned probabilities. Non-circled areas are likely ignored in *pre-attentive processing* (first 3-to-5 seconds).



The software makes ‘heat maps’ which glow brightest where people likely look most in first 3-to-5 seconds, with yellow to red most likely to get immediate attention; green to blue, less so, and grey-to-black areas ignored.

The program delineates the ‘visual sequence’ the human eye is most likely to follow; *fixation points* indicate spots where gaze settles sequentially, first through fourth, without conscious control.

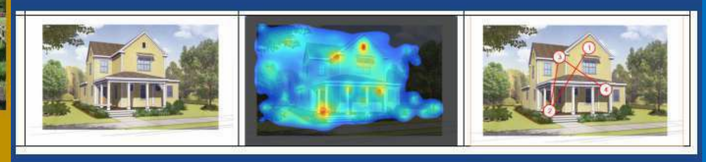
Conclusions

- Punched windows and porch columns attract the eye;

Blank facades don’t;

- “Fixations drive exploration” - we see here how street lined with porches provides the requisite points for easy ambulation, while a back parking alley does not.
- This makes walking on street at left easier and engaging.
- ‘Seeing’ the unseen gives new insight into what makes developments successful and suggests ways to improve existing ones.

Implications for Architecture + Planning



- Biometrics gives insight into which elements capture attention:
  - Enabling editing of designs before construction;
- Designers can study popular structures or streetscapes to learn the fixation points that *drive exploration* in those locations.
- Biometric tools can help assess + improve walkability, way-finding and overall design.

This study supported by the Devens Enterprise Commission, Devens, MA; Neil Angus, AICP, Planner, Peter Lowitt, AICP, Director
For full report: http://www.devensec.com/news/Eye_Tracking_Devens_1_11_18%20report.pdf
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Monitoring of User Experience in Controlled Spatial Environments:
Bibliotheca Alexandrina as a Case Study

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Sara Ebrahem. instructor/M.sc. College of engineering and technology, Arab Academy for science, Technology and Martime Transport, Alexandria, Egypt.

Introduction

Phenomenology of perception is the interpreter of the architectural spatial environment. It translates the swilling forces of spatial physical energy into an architectural experience happening in the brain. The senses act as gate ways, in which the spatial environment channels through into the user`s psyche. Neuroscientists assure upon studying images of the brain in action that the five senses are the fuel of emotions.

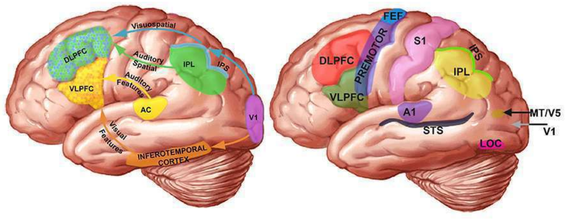
Major advances in neuroscientific multi-sensory interaction studies, show that multisensory regions account for sensory spatiotemporal integration, sensory substitution occurrence, supramodality, crossmodality, emotional and behavioral response, exposing that most, if not all neural processes are in some form multisensory

The Methods

On an interdisciplinary common ground between architecture and neuroscience, the research takes a speculative method, aiming to empirically determine the extents, in which phenomenological perceptions allow users to experience architectural spaces, overcoming the intellectual cognitive blindness through channeling the selective attention of the brain mechanism.

The entry spaces Bibliotheca Alexandrina are taken as a pilot case study, verified by a subsequent case study. Following a predetermined procedure based on neuroscientific-architectural findings, users are navigated through the spaces in interactive walk-throughs.

1 Multi-sensory interaction reporting to PFC (DLPFC & VLPFC) of behavioral response and spatial memory



Left: A depiction study of the flow of information from different sensory modalities to each other and to the PFC area in the brain, which is divided to main parts. The DLPFC, suggested to be essential in spatial working memory and divided attention. The VLPFC is responsible for integration of communication signals and action-related processing in the premotor cortex". **The overlap of sensory domains modalities in the PFC is indicative of multisensory processes of the brain**. Source: (Klemen & Chambers, 2012)

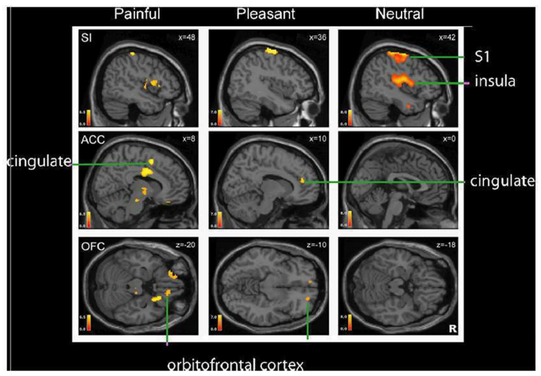
Right: A neuroscientific review of **a Multisensory cortical brain areas, showing a direct relation between multi-sensory interaction and spatial perception motion, behavior responsible areas**; Primary visual, Auditory and Somatosensory cortices,in the IPS: integration-for-action and spatial attention sites, MT/V5:motion sensitive area, LOC:object sensitive area, STS/IPL: biological motion integration sites, FEF: audio-visual attention and eye-movement control. Source: (Klemen & Chambers, 2012)

2 Multi-sensory and emotional response

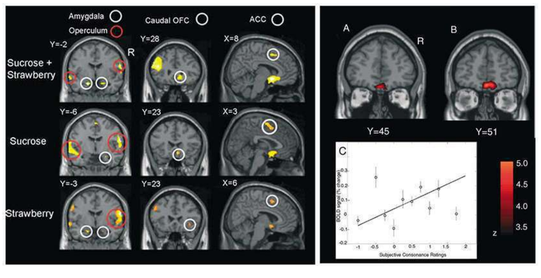
Orbitofrontal cortex OFC stimulation: mediating between sensory inputs, emotions, bebehavior, and The PFC area in the brain

OFC in general plays a distinctive role in reward feeling, emotions, decision making, environmental Adaptiveness, behavior. **The OFC** is an integration center for emotional content coming from other areas of the limbic system, and tinting decision attributes. it is Responsible for intuition or gut feelings. **OFC** inhibits motor responses, giving behavior adjustment accord ing to environmental changes (Krawczyk, 2002).

The Regions of the **OFC** are densely connected with many regions including the basal ganglia, amygdala, and other prefrontal areas, which allows the **OFC** to receive perceptual and emotional information. **Its association with the** DLPFC **and ventrolateral** PFC, **place the OFC in mediation between emotion and cognition** (Krawczyk, 2002).



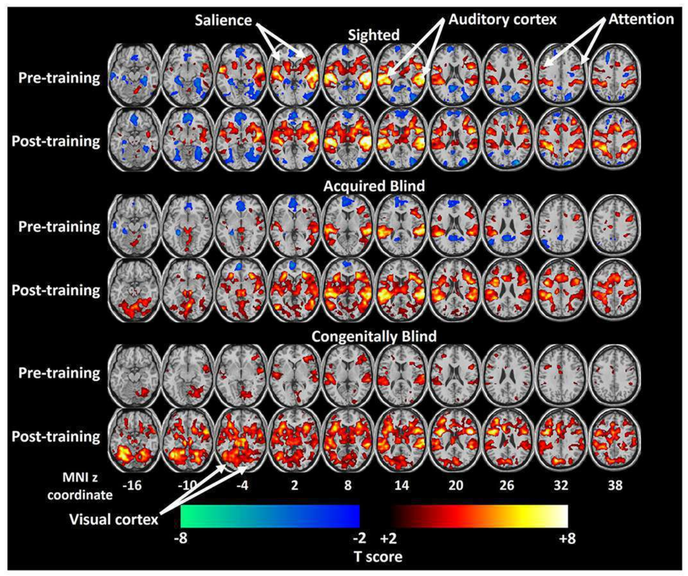
fMRI Brain activation to painful, pleasant and neutral touch of the human hand, shows the activation of ACC and OFC in painful and pleasant feeling, and the insula activation in neutral feeling. Those the brain areas are shown to be activated by smell and taste in the following studies. **The activation of OFC shows a relation to emotional and behavioral response. (Rolls, 2010).**



Left: shows the activation of four different brain regions to **odor-tasteless** solutions: The orbitofrontal cortex (OFC), Amygdala, operculum and ACC, which are close to supplementary motor cortex (SMA). **The activation of the OFC and the amygdala show a close relation between olfactory activation, emotion and behavioral response**.Source: (Araujo, Rolls, Bach, McGlone, & Philips, 2003)

Right: shows the activation of specific brain areas due to activation of **(taste-odor)** stimulus, believed to be **responsible for consonance and pleasantness feeling in the brain**. (A) shows consonance in activation of the medial part of the anterior OFC. (B) pleasantness and consonance of the activation of nearby medial part of the anterior OFC. Source: (Araujo, Rolls, Bach, McGlone, & Philips, 2003)

3 Sensory substitution (Phenomenonpathic response)



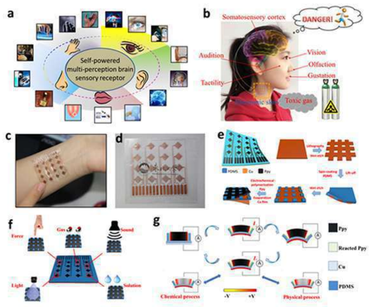
Audio-visual sensory substitution due to various tasks conducted using sighted, blind, and congenitally blind subjects in two situations: pre- training, and post training. Source: (Murphy, et al., 2016)

4 Multi-sensory empirical study at the Bibliotheca Alexandrina

Part of the Bibliotheca alexandrine empirical study including participants following predetermined procedure, based on neuroscience, and architectural literature review

Verification of the Bibliotheca Alexandrina empirical study results
Part of Secondary study in the Maritime simulator space at the AAST, Alexandria, Egypt. Including participants following the same predetermined procedure.

5 Will in some point in the future the architectural space can be sensory substitutive As this ground breaking Electronic skin?

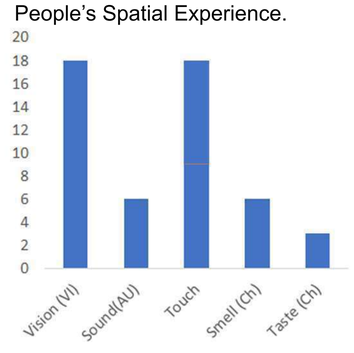


Experimental design of the self-powered multi-perception electronic-skin. Source: (Fu, et al., 2018)

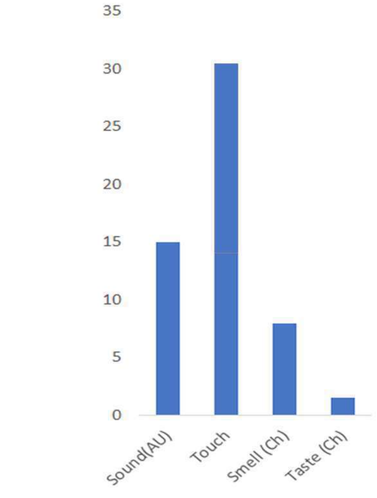
Conclusions & Discussion

1. The verification of the multi-sensory phenomenological nature of the architectural experience, giving intriguing indicator on the extend of impact of each sense and its ability to create emotional inclusive and sensory substitutive experience.

2. Extract Speculative Ratio of The Influence/Impact of Each Sense on People's Spatial Experience.



3.The Sensitivity to the non-visual senses is much higher when vision is excluded, but still retain the same ratio to each other.



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Contributed Posters #2
Friday, September 21st | 10:45 – 11:45 PM

Mark Hewitt, Mark Alan Hewitt Architects / New Jersey
Is Ornament Necessary?

Andrea de Paiva, FGV Projectos / Rio de Janeiro, Brazil
Emotions and Senses: The Relation Between Architecture, Emotion and Perception

Bianca Predoi, BPArchitecture / Belgium
A Neuroesthetics of Ionian Capital

Tomáš Vlcek, Charles University and Art and Architecture of Technical University in Liberec / Prague
Topological Anticipation of Modern Paterns and Visions in Baroque

Maria da Piedade Ferreira, TU Kaiserslautern / Germany
Embodied Emotions

Hanna Negami, University of Waterloo / Ontario, Canada
Investigating Threat-Baned and Positive Awe in the Built Environment

Michael Arbib, University of San Diego California / San Diego, California
From Neural Space to Physical Space: Giving a "Brain" to a Building

Esa Laaksonen, Aalto University, Espoo / Finland
Neural Mirroring Architecture – Empathy and Atmosphere

Rafaela Paes de Andrade Arcoverde, Federal University of Pernambuco / UFPE
Architecture, Light And Emotion: The Brennand Chapel by Paulo Mendes Da Rocha, in Recife, Brazil

David Redemske, HDRINC / Chicago, Illinois
The Criminalization of the Mentally Ill within the US Prison System

Jatheesh Srikantharajah, Collin Ellard & Bob Condia, University of Waterloo & Kansas State University/ Ontario, Canada & Manhattan, Kansas
Place, Peripheral Vision, and Space Perception: A Pilot Study in VR

Diane Zoura, domusstudio architecture / San Diego, California
Suppressing the Visual Sense to Enhance the Experiences of Spiritual Spaces

Jain Kwon, University of Georgia – School of Art / Athens, Georgia & Juyeon Kim, Soonsil University / Seoul, Korea
Individuals' Visual Attention to Interior Elements in the Audio-visual Context of Lived Experiences

Young-Hee Min, Yonsei University / Seoul, South Korea
Color Contribution to Environmental Legibility, Relations of Objective Performance and Subjective Perception in Wayfinding

Emotions & Senses

the relation between architecture, emotion and perception

NOTRE-DAME CATHEDRAL DOM BOSCO CATHEDRAL

Same religion, different architectures. Do they evoke the same emotions and feelings?

HALDEN PRISION, NORWAY

"We don't have bars, we have windows, you feel like a human, not an animal." Linn Andreassen. Architecture for punishment or rehabilitation?

"Awareness of your surroundings occurs only when sensory inputs violate expectations. When the world is successfully predicted away, awareness is not needed because the brain is doing its job well." [5]

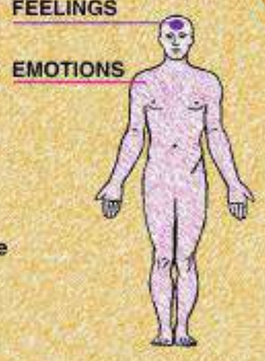
EMOTIONS

Etymology: act of moving.

Emotions are part of the machinery that help biological regulation.

Emotions happen in the whole body.
Feelings happen in the brain, they are mental experiences of body states, which arise as the brain interprets emotions.

Everyone is hardwired to have emotions, they are innate reactions of the brain that are expressed through facial expressions, body language and attitudes [3].



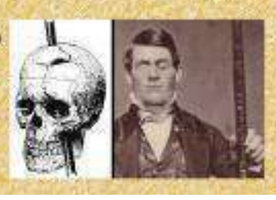
There are six universal emotions.

While feelings might have some cultural influence; emotions, are universal [3]. New Guinea natives that live isolated show the same facial expressions as americans.

Emotions exist to help social beings qualify things and/or situations and make decisions to survive in a complex world.

Mammals have emotions, but feelings are unique to humans. They offer more flexibility to the decision-making process.

The systems that generate primary emotions (innate emotions) are located mainly in the Limbic System. Secondary emotions (those influenced by experience) involve processes in the prefrontal cortex. People with lesions in the prefrontal cortex, like Phineas Gage and Charles Whitman, showed great changes in behavior and decision making.



The built environment impacts behavior. Neuroscience applied to architecture has proved that different environments can evoke emotions and influence brain processes. Can a building arouse negative or positive emotions? If individuals feel different, will that change their behavior?

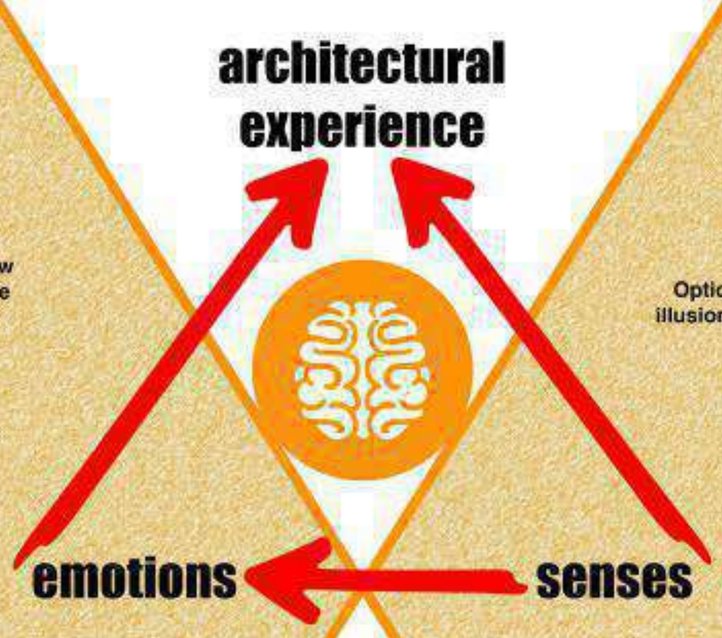
The brain is hardwired to provoke emotions in response to stimuli from outside and inside the human body. According to Damasio [1], emotions are generated in the brain and experienced by the whole body. These are innate reactions of the brain that are expressed on facial expressions, body language and attitudes [3]. They affect the way people feel (consciously or unconsciously) since feelings are mental experiences of body states, which arise as the brain interprets emotions [1]. That, in turn, triggers changes in behavior and wellbeing.

But what environmental features will change emotional states? And how does it happen? The brain uses the information brought by all senses to create its own perception of reality. And it is hard-wired to respond to some stimuli with emotions to help survival. Sizes, shapes, colors, proportions, temperatures, smells, movements, sounds, body states, those are some of the features that alone or combined can induce the brain to react generating a specific emotional state.

As a result, under the influence of the emotion generated, people tend to change their pattern of behavior. If the emotion aroused is fear, individuals tend to act in a more selfish and attentive way, less social and creative. If the emotion is anger, individuals might act in a more impulsive and aggressive way. Such emotional states will not only impact on externalized behavior, but memory formation and learning might change as well. Even if individuals do not feel such emotions consciously, the changes on their body states make them act differently without necessarily noticing it.

What is even more interesting is that such changes in emotional states will also change the way people perceive the environments and situations surrounding them. A person feeling joy might notice the space as more beautiful, even more colorful than a person feeling sadness. As affirmed by the neuroscientist David Eagleman, "our perception of reality has less to do with what's happening out there, and more to do with what's happening inside our brain" [5].

In conclusion, the relation between senses, emotions and the experience of architecture and behavior is a complex and two-way path. Although the space is the same, emotional states can change perception of architecture. On the other hand, architecture can be perceived by the senses and arouse different emotional states that alter behavior and the very experience of architecture itself.



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Built in the 1950's, nearly abandoned in the 1960's and demolished in the 1970's. How could "an oasis in the desert", as it was considered, deteriorate into a decaying, dangerous, crime-infested neighborhood in less than 20 years?

PRUITT-IGOE HOUSING PROJECT, USA

Why have Alejandro Aravena's housing projects been a great success? What emotions are generated by the possibility of space customization?

VILLA VERDE HOUSING, CHILE

What feelings architecture of power invoke on the powerful ones? What will be the feelings evoked on those that do not feel that they belong there?

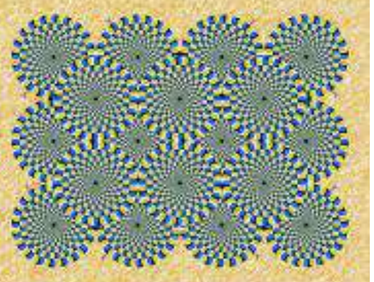
SENSES

Senses are faculties by which the body perceives an external stimulus.

Perception is constrained by our biology.

The brain integrates all the information brought by the senses and c reates its own perceptions of reality."Instead of reality being passively recorded by the brain, it is actively constructed by it" [5].

Some senses can alter perception. The color of a place can make people feel tastes differently, for instance.



Optical illusions like the Illusory Motion or the auditory illusion Tritone Paradox are examples of how people can have different perceptions of the same reality.

Visual perception occupies a great portion of the cortex. But there is also a direct pathway to the amygdala that mediates rapid non-conscious processing of salient information.

The sense of smell detects various stimuli, from hazards to pheromones, as well as food. It is the only sense that connects directly with the Limbic System (involved in memory formation and emotion).

Audition is the only sense that can have a direct impact on brain waves, inducing specific mental states. Sound is involved in spiritual connections, and emotional engagement.

The somatosensory system detects changes at the surface or inside the body. Touch is extremely important to generate connection (with other individuals and with the environment), as shown by Harry Harlow's experiment in 1958 (infant monkeys had two artificial surrogate mothers, one had a bottle of milk while the other one was covered with cloth; they bonded with the cloth mother even though it lacked a source of nutrition).

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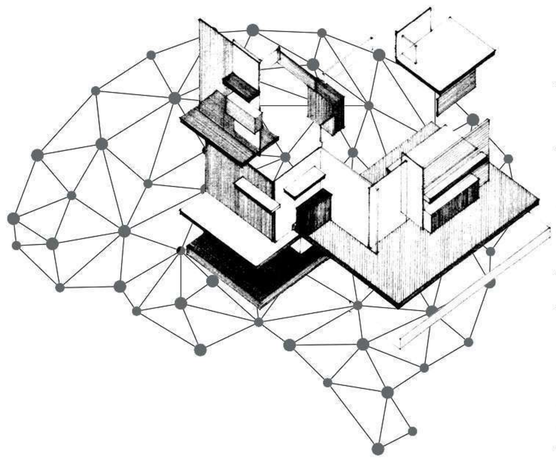
neurotest for architecture

NTA

Bianca PREDOI PhD, architect - BPArchitecture, Brussels, Belgium



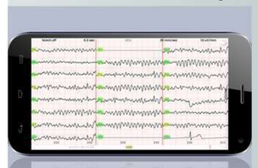
ABSTRACT

**Neuro-Test for Architecture (NTA) supports research in neuroscience applied to concrete situations in the fields of architecture and urbanism.
It assess the brain's reaction to built space when visual contact occurs with virtual or built environment. Depending on the brain response, we are able to conclude whether the space created by the architects corresponds to the architectural programme they had initially conceived, or not.
NTA is an evaluation tool for projects at: either final avant-project stage, where NTA, using 3D digital images, helps clarifying the correspondence of the design against a requested architectural programme; or at completed stage, where NTA helps to precisely visualise where the critical points of perception are in an existing architectural or urban configuration1. Brain responses to visual stimuli of the built space have become measurable with the advance of the neuroimaging procedures.
Based upon existing experimental research, NTA refers to the behavioural neuroscience of visual processing of 3D VR/AR digital images of architectural renderings and with the brain response within a real built environment.
Aesthetics, planning and engineering of the architectural/urban projects have an impact on neuronal and psychological factors that influence us and our wellbeing. Indeed, the brain is the most active part of our body involved in perceiving the built space and ourselves, therefore in creating our experience of the world around us. Nevertheless the architects can often be absorbed by overwhelming technical, environmental, legal, and contractual demands throughout project process and end up with finished buildings to which people do not respond to as expected and planned. Sometimes suppositions, even when based on proper methods of architectural analysis, can be deceiving. Sometimes having the real spatial experience during a long amount of time within an inappropriate built environment can make living there a nightmare. In response, he brain gives an immediate feedback of spatial perception when contact with such spaces. It is thus legitimate to ask whether an architectural or urban configuration (rendered as 3D virtual image of an architectural concept) or a real built space subject to transformation (conversion, layout, optimisation) corresponds to our real needs.
NTA is a tool designed to answer to this question.**

IMAGE: LILI SAMS/MASHABLE

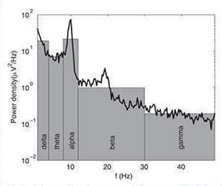
Occipital's Bridge - VR headset combined with the company's Structure Sensor technology, for augmented-reality

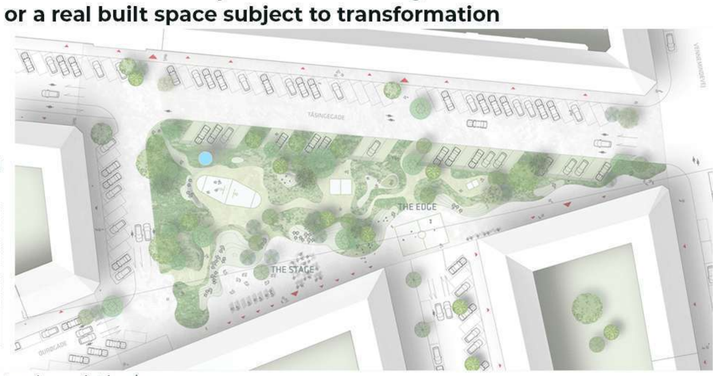
EMOTIV Insight 5 Channel Mobile EEG



AndroidAPP_phone1-800x600
OpenViBE - open source software platform dedicated to designing, testing and using braincomputer interfaces

Saint-Kjelds-Climate-Adapted-Neighborhood by-Tredje-Natur





Copenhagen-climate-neighbourhood-At the International Water Association's 'Embrace the Water' conference in Gothenburg, Sweden, 2017

EXECUTION

Every architecture programme has a specific approach in domains with all range of functions including cultural, residential, commercial, leisure and civic projects, as well as master planning and urban planning projects. Programmes describe the requirements that need to be reconciled and accommodated by a building or other structure, developed first as a design which is submitted for approval, and subsequently constructed1. As a statement of a client's requirements, a programme has a clear set of instructions setting out the overarching goals and detailed requirements that will emerge which form the starting point of the architect's designs and will be continually tested against, as design progress.;NTA is very useful in complex projects, where the architect's design will need to acknowledge the different design responses to be made and where the critical aspects of the brief/programme could be simplified by using an eloquent test referring to the human factor, meaning the users and their wellbeing.
NTA could be highly helpful for critical facilities, where the design against the brief/programme meets difficulties, and the report that shows how and where, the design meets the brief find difficult to be validate by the architect's tools and knowledge. It helps to split all the services or functions to be accommodated, decomposing these functions to activities that will be listed for analysis by a specific number of subjects belonging to the targeted users of the building. According the studies in neuroimaging, EEG techniques are fast enough to measure neural function down to 100th of a millisecond, which corresponds closely to brain processing speed2. Such fast recordings allow very clear functional measurements of brain performance with regard to thinking and processing visual information.
Following the analysis' results in healthy individuals, the NTA test branches out in three protocols:
1. First protocol/ NTAμ0: A check test of
healthy individuals selection among the targeted public of the architectural scene in discussion, the test will determine where, also why the brain is not functioning properly, in correspondence with the architect suppositions related to a specific programme;
2. Second protocol/ NTAμ1:The second protocol shows the degree of discomfort in the brain when the eye gaze sees the 3D visual or real image;
3. Third protocol/ NTAμ2: Finally, after detailed interpretation of NTAμ0 and NTA μ1 data and subsequent corrections of the architectural design, the project is submitted to the third protocol in order to observe whether the initial stressed or inadequate brain response at NTAμ1 has shrink or has entirely disappeared as a result of the corrections.
Architects will use NTA to verify, as well as assure that the project is correctly adequate to their clients' requested commission.

Experiencing a real environment or a virtual image thereof produces an instant neuronal feedback which can specifically target pathways resulting in discomfort to the observer. NTA aims at identifying and correcting in detail the elements that cause stress at visual contact, so the brain response of distress is lowered. That way, the brain activity is improved by restoring the brain response into healthy ranges (i.e. EEG green conventional response), thereby reconnecting the neural pathways that had been previously disconnected. The result is an improvement in brain regulation according to a better architectural design.

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URBAN IMAGES Copenhagen-climate-neighbourhood-At the International Water Association's 'Embrace the Water' conference in Gothenburg, Sweden, Helle Søholt. 2017.

Jaroslav Nešetřil and Tomáš Vlček

Interdisciplinary Seminar of Tocpological Studies in Poetics of Art, Landscape and Architecture, Faculty of Mathematics and Physics of Charles University - Faculty of Art and Architecture of Technical University in Liberec

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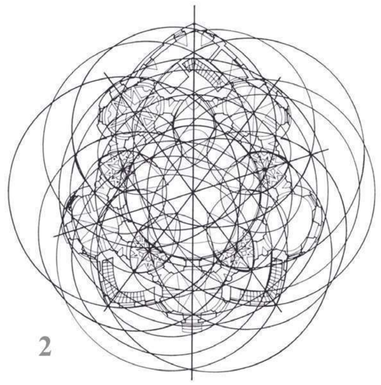
TOPOLOGICAL ANTICIPATIONS OF MODERN PATTERNS AND VISIONS IN BAROQUE PERIOD

Thesis: In the history of creativity and thinking, the roots of paradigm shifts are deeper than expected. Traditional ways of interpretation of the history of art are focused on formal appearance of works of art and architecture, or their symbolic meaning. Such approaches are however inadequate to the task of understanding of art as a creative process of interaction of senses with the intellect. Inspired by a rather provocative hypothesis by Gilles Deleuze identifying a fold as a key shape of birth of Modernity in the Baroque Leibniz mathematics we are studying some other stimuli of changes in cultural history of Baroque. We believe that this these can be interpreted in the context of neurosciences, mathematics, architecture and biology.


1

Theme: In the centre of our attention is a network of attempts of the intellectuals of Baroque time to understand science and art as something much more complex than are only isolated disciplines of creativity and knowledge. There were much more significant motives of Baroque to develop a manifolded cultural discourse consisting of interactions and penetrations of artistic and scientific disciplines than use to be taken in account in the majority of approaches to Baroque art in the history of art since 19th century up today. Athanasius Kircher's concepts of Museum Kircherianum, Giambattista Vico's role of poetic wisdom in Scienza Nuova, Blaise Pascal meditation on two meaning of geometry, Cesare Ripa's emblemata together with Amos Comenius Orbis pictus are some of the cases of interacting disciplines and areas of Baroque discourse.

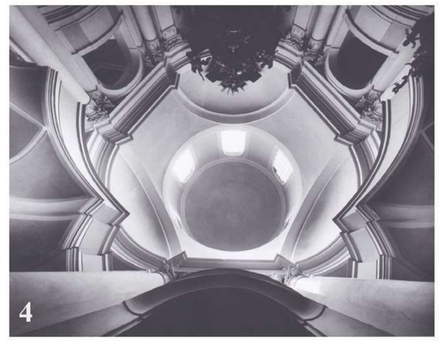

2

Case study: the Santini-Aichel's works of architecture as a subject of an interplay of divers knowledges and skills, as well as in architectural and mental construction of shapes in mind and space, in the combination of cabala-mathematics and linguistics, in the combination of the new, or personal architectural elements together with vocabulary of the historical manifestation of architectural language and visions, particularly with Gothic art. This analysis does not just involves genius loci and history account but the whole mind set and socio-economical setting of middle Europe in transition from distant past towards future. The subject of Santini Aichel architecture calls for an innovative topological approach thus revealing the latent, processing structure. This kind of research may be as well interesting from contemporary scientific point of view and undertaken deconstruction of the whole cultural context.


3

Jan Blažej Santini Aichel: *Chapel of St. Anne*, Panenské Břežany, Czech Republic *(1705 - 1707)* and *Church of Saint Johann of Nepomuk*, Green Mountain in Žďár nad Sázavou, Czech Republic (1720 - 1722)

Santini found a task to built a new pilgrimage church in Green Mountain as an opportunity to introduce his concept of architecture as a case of fascinating visual representation. In his work, a combination of divers paradigm came together which originated in different modes of geometry starting with euclidian background and continuing with cabala, conic section up to other basic inventions. The same concerns the matter of construction and statics when he was achieving symbioses full of tensions and paradoxes.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Santini's style made the work of architecture a case of interplay of various elements and meanings using transitions of the visual (particularly elements of gothic and baroque orders) into invisible (as well as abstract, verbal, spiritual). He developed a powerful interplay of the apparent architectural fragments with hidden geometrical patterns and with different style connotations, all together as a challenge for pilgrims and visitors mind to participate on his blessed creativity and imagination. Santini's architecture contributed to new tendency of late baroque to connect separated Cartesian categories of res extensa and res cogitans and to make architecture a matter of emotions based in a dynamic interplay of abstract, mathematical and verbal patterns with spatial affects, percepts and visions.

Related literature

*Damish, H.,*Noah's ark, *(MIT Press, 2016)*
Nešetřil, J., Vlček, T., Topological Seminar of Poetics, *(in preparation)*
Kalista, Z., The Face of the Baroque, *(Munich, 1982)*
Petříček, M., Filosofie en noir, *(Prague, 2018)*
Sarti, A., Citti, G., Piotrovski, D., Differential heterogenesis and the emergence of semiotic function, *(Semiotika, 2018; in press)*
Vlček, T., Vojtěch Preissig, *(Kant, 2018)*
Onions J., Rykwert J., Veselý D, Vidler A., Vlček T., ed., Column, Vase, Obelisk (*Prague, 2005)*

1) *Pilgrimage Church of Saint Johann of Nepomuk, Green Mountain in Žďár nad Sázavou, Czech Republic;* ***2)*** *Geometrical forms in the ground-plan of the Pilgrimage Church of Saint Johann of Nepomuk, Green Mountain in Žďár nad Sázavou, Czech Republic;* ***3)*** *Pilgrimage Church of Saint Johann of Nepomuk, Green Mountain in Žďár nad Sázavou, Czech Republic;* ***4)*** *Chapel of St. Anne, Panenské Břežany, Czech Republic*

Investigating Threat-Based and Positive Awe in the Built Environment

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Threat-Based and Positive Awe

What is awe?

- A fleeting but powerful self-transcendent emotion[1], awe is an emotion experienced when confronted by something so vast that it challenges one's current representation of the world[2].

The sublime and 'dark awe'

- Empirical work on awe has recently shifted from treating it as a purely positive emotion to focusing on a darker side of awe, one elicited by a threatening stimulus[4].
- Unlike positive awe, which has been demonstrated to produce cognitive, social, and physiological benefits[3-8], threat-based awe is associated with more negative outcomes, such as greater fear and feelings of **powerlessness**, lower self-control, and increased physiological arousal[9].
- Despite these divergent outcomes between threat-based and positive awe, both forms of awe result in a **diminished sense of self** in the face of a vast stimulus[9, 10, 11].

Awe in Architecture

The current study

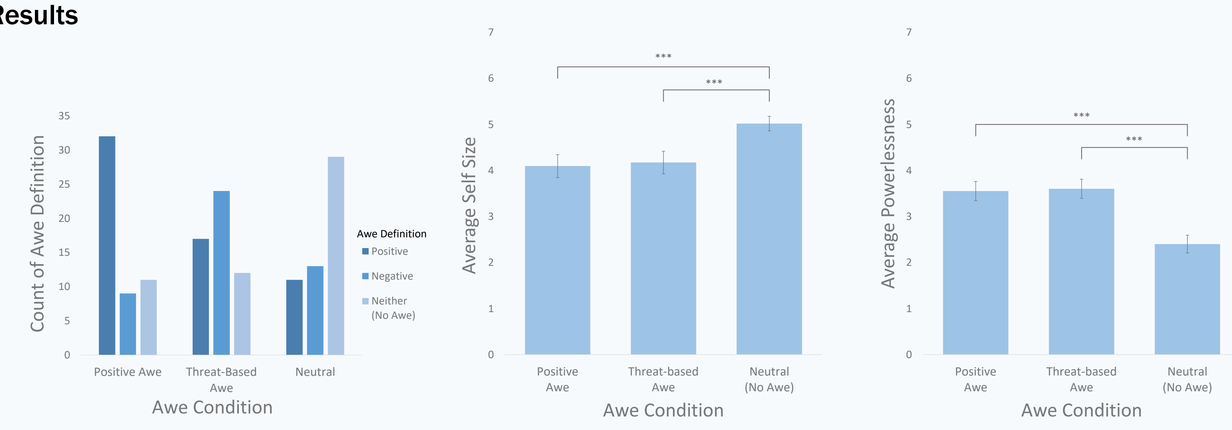
- Although the vast majority of empirical work on awe has relied on nature imagery to evoke awe, the built environment, being socially meaningful, holds enormous significance for behavioral effects of awe.
- We present data from a replication of effects distinguishing threat-based and positive awe using videos of natural scenery[9].
- Building on our past work on awe in architecture[12], we seek to extend these findings to the built environment.
- We predict the same results using videos of positive and negative awe-inducing architectural settings.

Figure 1. Stills from the videos used to induce positive awe (left) and threat-based awe (right). The control video was an instructional video on fence building.

Method

- 100 Amazon Mechanical Turk workers participated in an online study. Our final sample consisted of 53 participants (*M* age = 33, *SD* = 11; 37.7% female).
- Participants viewed three videos, indicated whether they felt threat-based or positive awe, and rated **how small they felt** and **how powerless they felt** as they watched each video.

Results



Conclusions

- Both positive and threat-based awe led to a smaller sense of self, compared to a control condition, replicating previous work.
- Both forms of awe led to greater feelings of powerlessness, as compared to feeling no awe.
- Although previous work found that threat-based awe resulted in feeling more powerless than positive awe, we found no difference in powerlessness between these conditions, perhaps indicating more overlap between these forms of awe than currently theorized.

Future Directions

- Future work will investigate social effects of feeling threat-based and positive awe in architectural settings.
- This project has implications for how we understand awe-eliciting structures, from those in which we might experience positive effects of awe – such as cathedrals and opera halls – to those in which we may see a darker, more negative effect of awe – such as prisons or other institutional buildings designed to effect emotional control.

Figure 2. Structures that may evoke positive or threat-based awe. Religious monumental architecture has been theorized to facilitate religious experience through evoking awe[13]. Skyscrapers have been found to produce behavioral freezing[14], a common defense response.

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THE CRIMINALIZATION OF THE MENTALLY ILL WITHIN THE U.S. PRISON SYSTEM

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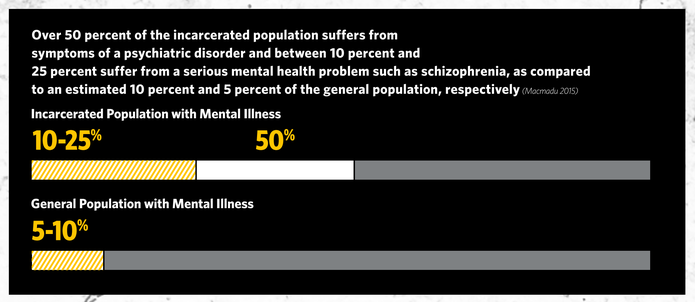
The United States has the most incarcerated individuals of any country *(Rich, Wakeman, & Dickman, 2011; Wilper et al., 2009)*. At the end of 2014, the United States held an estimated 1,561,500 prisoners in state and federal facilities *(Carson, 2015)*. Among incarcerated adults, rates of mental illness and suicide are at least double compared to the general population *(Cropsey, Binswanger, Clark, & Taxman, 2012)*.

Many inmates also suffer from substance abuse disorders, with prevalence rates four times as high as that of the general population *(Cropsey et al., 2012)*. Even though half of U.S. inmates have a psychiatric disorder, and they have prevalence rates of major depression and psychotic disorders four to eight times as high as the general population, only 22% of state prisoners receive treatment while incarcerated *(Rich et al., 2011)*. While inmates with severe mental health conditions are routinely treated, those with more subtle conditions are usually not treated until they decompensate and the conditions worsen *(Anno, 2004)*.

Prisoners become members of their community when released *(Ha & Robinson, 2011)*. If we do not treat inmate's medical and mental health conditions while incarcerated, they will bring those conditions right back to their communities.

$15 billion **Is the estimated cost of incarcerating inmates with severe mental health disorders annually** *(Kinsella, 2004)*.

Over 50 percent of the incarcerated population suffers from symptoms of a psychiatric disorder and between 10 percent and 25 percent suffer from a serious mental health problem such as schizophrenia, as compared to an estimated 10 percent and 5 percent of the general population, respectively *(Macmadu 2015)*

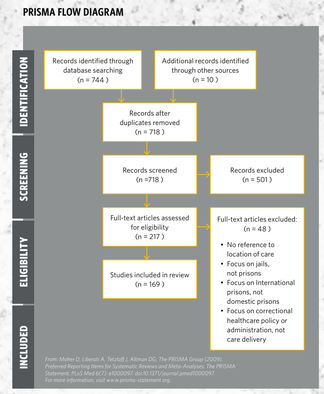


METHODS

The purpose of this literature review was to shed light on the healthcare process and settings for prison inmates with mental illness, and to generate recommendations for the future. A systematic review of the literature was conducted, including key word searches of several relevant databases, title and abstract reviews, and full text review of 169 pertinent sources.

The information presented comes from a larger literature review of healthcare in prisons, where two researchers qualitatively analyzed the records and engaged in an iterative process of review and identification of themes relevant to provisions of space. Themes included: operational models of care, costs of care, inmate-patient demographics, inmate-patient transportation, potential partnerships, current state processes, criminal justice policy, technology, training, and inmate-patient outcomes.

PRISMA FLOW DIAGRAM



95% **of inmates will eventually be released back into their communities.**

(Fraser Hale, Brewer, & Ferguson, 2008; Trestman, Ferguson, & Dickert, 2015; Wang et al., 2014).

$137 **per inmate per day to house a mentally ill inmate in prison** *(Kinsella, 2004).*

$60 **per patient per day for community mental health programs**

RESULTS

Two public policies adopted over the last 30 years have been the catalyst for the increased number of mentally ill persons in the U.S. who are now incarcerated in prisons *(Abramsky, 2003)*. First, a lack of funding, support and direction for the community mental health system, after the "deinstitutionalization" of the 1960s *(Abramsky, 2003)*. Second, the embracing of a punitive anti-crime agenda including the "war on drugs" *(Abramsky, 2003)*. These policies dramatically expanded the prison population, the number of people sentenced for non-violent crimes, and the sentence length *(Abramsky, 2003)*.

There are three times more mentally ill people in prisons in the U.S. than there are in mental health facilities *(Abramsky, 2003; Reingle Gonzalez & Connell, 2014)*.

DIFFICULTIES FOR THE MENTALLY ILL IN PRISONS

The mentally ill are more susceptible to victimization from other inmates such as, assault, sexual assault, extortion and exploitation *(Abramsky, 2003)*. Mentally ill prisoners will also find it difficult to consistently comply with prison rules *(Abramsky, 2003; Reingle Gonzalez & Connell, 2014)*.

19% **Although mentally ill prisoners account for only 19% of the prision popultion...**

41% **They account for 41% of the disciplinary infractions.** *(Abramsky, 2003).*

SEGREGATION

Mentally ill prisoners are typically housed in segregated units, even though the isolated confinement can cause psychiatric breakdown *(Abramsky, 2003)*. The prison system then is not only acting as a warehouse for the mentally ill, but they are becoming an "incubator" for worsening illnesses and psychiatric breakdowns *(Abramsky, 2003)*. An unfortunate cycle exists where mentally ill inmates are transferred from segregation to inpatient psychiatric centers, only to be released back into segregation once they stabilize *(Abramsky, 2003)*. This process puts them back into the same facility that caused the deterioration to begin with *(Abramsky, 2003)*. At the time of their study, Abramsky (2003) noted that courts are now starting to rule that it is against the Eighth Amendment to house mentally ill inmates in segregation.

MENTAL HEALTH & RECIDIVISM

Inmates who were diagnosed with any mental health disorder were 70% more likely to re-offend, than an inmate without a mental health diagnosis *(Reingle Gonzalez & Connell, 2014)*.

50-230% **Among former prisoners, the recidivism rates of inmates with a mental health disorder are 50-230% higher than inmates without a mental health disorder** *(Reingle Gonzalez & Connell, 2014).*

DISCHARGE PLANNING

Many times, mentally ill inmates are released back into the community with as little as a one-week supply of medications *(Abramsky, 2003)*. This is frequently not enough medication to hold them over until an appointment with a community provider can be scheduled *(Abramsky, 2003)*. Thirty-four percent of adult correctional facilities do not provide discharge planning services, and for those that do, the extent and quality of that service is unknown *(Abramsky, 2003)*.

During the two weeks after release, inmates are...

13x **more likely to die than the general population**

129x **more likely to die of a drug overdose**

(Dumont, Brockmann, Dickman, Alexander, & Rich, 2012; Macmadu & Rich, 2015; Rich et al., 2011).

LACK OF COMMUNITY SERVICES

Society has been reluctant in recent years to fund new, or even maintain, existing mental health treatment services *(Lamb & Weinberger, 2005)*. Because of this, it is unfortunate that prisons may be the only remaining institution where quality psychiatric care can be received *(Lamb & Weinberger, 2005)*. The lack of adequate community mental health resources shows a direct link to the number of incarcerated individuals with a mental illness *(Abramsky, 2003)*.

THE MENTALLY ILL & LAW ENFORCEMENT

Because people with severe mental illness who are now living in the community are not getting adequate treatment, it increases the possibility they will interact with law enforcement *(Lamb & Weinberger, 2005)*. In such cases, law enforcement may not recognize they are dealing with someone with a mental illness *(Lamb & Weinberger, 2005; Reingle Gonzalez & Connell, 2014)*. Once entered into the system as an "offender," a mentally ill person will be considered a criminal by both law enforcement and possibly the courts *(Lamb & Weinberger, 2005)*. As more interaction with law enforcement happens, the courts may be influenced more by their "long criminal history," than their mental illness and thus send them to the corrections environment *(Lamb & Weinberger, 2005)*.

ALTERNATIVES TO PRISON—DRUG COURTS & DIVERGENT CENTERS

Mental health courts are designed to decrease the criminalization of the mentally ill, by hearing cases of people with mental illness who have been charged with crimes *(Lamb & Weinberger, 2005)* These courts collaborate with mental health practitioners to create a treatment plan that includes medications, therapies, housing, and rehabilitation *(Lamb & Weinberger, 2005)*

Because of this paradigm shift in the U.S., many people now get their inpatient mental health treatment in prisons *(Lamb & Weinberger, 2005; Reingle Gonzalez & Connell, 2014)*. In fact, Los Angeles County Jail, Chicago's Cook County Jail and New York's Riker's Island now house more people with serious mental illness than in any of the nation's psychiatric hospitals *(Macmadu & Rich, 2015)*. The lack of adequate community mental health resources shows a direct link to the number of incarcerated individuals with a mental illness *(Abramsky, 2003)*. Thousands have been prosecuted for crimes they would have never committed if they had access to adequate mental healthcare in their communities *(Abramsky, 2003)*.

Addiction and mental health treatment programs are more humane, cost effective, and better alternatives to incarceration for addressing the underlying problems of these conditions *(Rich et al., 2011)*. Though these programs have proved successful, many policy-makers have not supported these approaches, as they did not want to be labeled as "soft on crime" *(Rich et al., 2011)*.

1/3 **A study in Connecticut noted that the cost of offenders who were diverted into drug treatment programs was about a third of the cost of those who were not** *(Abramsky, 2003).*

Prisons were never intended to be care centers for the mentally ill; however, that is one of their primary functions today *(Abramsky, 2003)*. Prisons have been described as "toxic" environments for the seriously mentally ill by many mental health providers *(Abramsky, 2003)*. They are overcrowded and tense places where all prisoners struggle to maintain stability, despite the presence of violence, the lack of privacy, limited family contact, and few, if any, educational and work opportunities *(Abramsky, 2003)*. In addition, mentally ill prisoners are typically housed in segregated units, even though the isolated confinement can cause psychiatric breakdown *(Abramsky, 2003)*. Law enforcement and legal and mental health professionals are concerned that prisons have become the main treatment option for people with mental illness *(Lamb & Weinberger, 2005)*. Even where good quality care, provided by mental health professionals, is being provided in prisons, it still doesn't solve the issue of treating the mentally ill in an environment designed for punishment and not treatment *(Lamb & Weinberger, 2005)*.

CONCLUSIONS

The U.S. prison system is at a crossroads. Funding was never provided for community-based mental health services after the deinstitutionalization of the 1960s. Because of this, thousands have been prosecuted for crimes they wouldn't have committed if they had access to therapy, medications, and assisted living in the community *(Abramsky, 2003)*. Law enforcement, the legal system, and mental health professionals do not want prisons to be the primary provider of mental healthcare services *(Lamb & Weinberger, 2005)*; however, that is what they have become today. There has to be a complete paradigm shift, from incarcerating the mentally ill, to providing services and care in the community, and therefore de-criminalizing mental illness. By filtering funds to community-based mental health treatment, in lieu of prisons, the U.S. can: lower the population of its prisons, and provide much needed care to a marginalized population, save on correctional health care costs, and provide the proper mental health treatment in a setting designed for healing, in lieu of punishment.

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Place, Peripheral Vision, and Space Perception: A Pilot Study in VR

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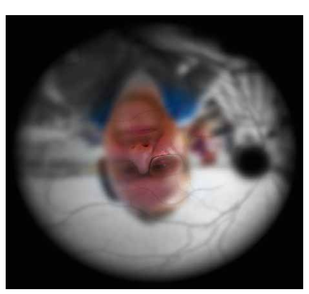
PURPOSE

- This study investigated the mechanisms through which the visual experience of the built environment affects people
- Due to the structure of the visual system, information is processed differently depending on its location in the visual field
- We aimed to identify whether central and peripheral vision serve different functions in processing architecture

THEORY

- Central vision comprises the central 10 degrees of the visual field, while peripheral vision involves everything outside of that
- In the retina, there are many more photoreceptors in the centre than the periphery of the visual field



Depiction of the resolution of an image in the retina, decreasing with distance from the centre. Image is inverted due to the curvature of the eye.

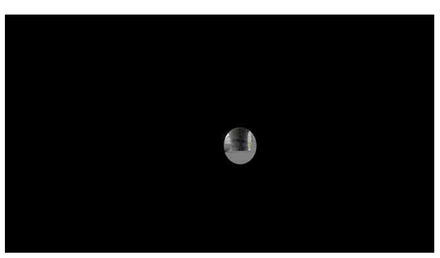
- Central vision is specialized for tasks involving processing minute details, such as colour and object recognition
- Peripheral vision is responsible for understanding the gist of a scene and processing its layout
- Recent theory argues that peripheral vision is important for processing the atmosphere of the surrounding environment

METHOD

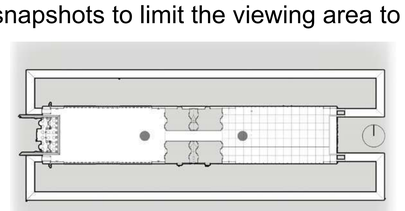
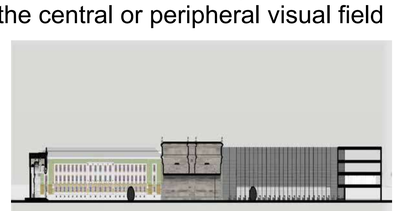
- We aimed to isolate central and peripheral vision to test their influence on the experience of architecture
- Participants were presented with two models of public squares through a VR headset for 82 seconds each
- Participants were in one of three conditions: central, peripheral, or full vision

- Two models of connected, equally-proportioned public squares were designed, with one in a classical style and the other in a modern style


- Participants viewed a series of snapshots taken at different locations designed to give the impression of movement through the squares



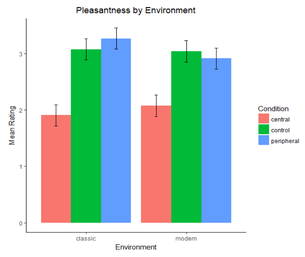

- In the central and peripheral conditions, a filter was overlaid on top of the snapshots to limit the viewing area to either the central or peripheral visual field

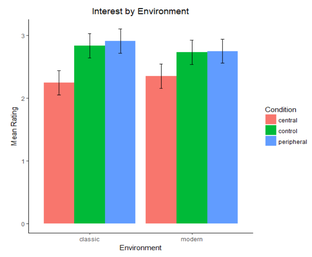



A general floor plan (left) and cross-sectional drawing (right) of the model. The shaded circles are chrome eggs used as points of interest in the public squares. In each drawing, the classical square is in the left and the modern square is in the right.

RESULTS

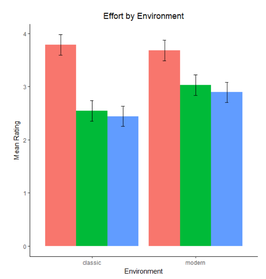
- Across both the modern and classical designs, perception of the public squares was more positive when viewed through peripheral vision rather than central vision

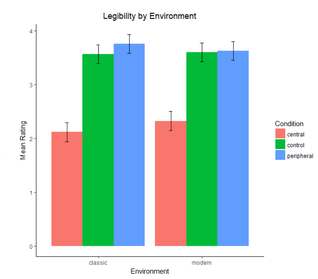




Ratings of pleasantness (left) and interestingness (right)

- The environments presented a greater challenge to process in the absence of peripheral vision





Effort expended (left) and legibility (right)

CONCLUSIONS

- Peripheral vision plays an important role in processing and reacting to architecture
- For architectural design, information in the visual periphery may have a substantial impact on observers' experiences
- In a second study, people possess reliable affective impressions of rapidly presented scenes in the periphery
- Peripheral vision may be important for first impressions

FUTURE DIRECTIONS

- Investigate the temporal dynamics of processing information from the central and peripheral visual fields
- Peripheral vision is specialized for rapid processing, and may be more important when first viewing a scene
- Use real-world studies to understand how central and peripheral vision interact in the experience of architecture

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ACKNOWLEDGEMENTS

We would like to thank Richard Marion, Andrew Huss, and Eric Blair for programming the virtual environment and constructing the models of the two environments. This work was supported by grants from the Social Sciences and Research Council of Canada and the Driehaus Foundation.

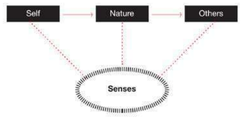
SUPPRESSING THE VISUAL SENSE

DIANE ZOURA

What is spirituality?

Humanity has evolved so much throughout history. What we have that other beings don't have is a spirit. Spirituality is a universal human experience. It is when our mind, body and spirit come together. Spirituality is connecting to your core and focusing on the meaning and purpose of your existence. Connecting to our spirituality is something that all human beings long for, whether we like to acknowledge it or not.

It is important for humans to connect to their spirituality because when we are one with our spirit, not only do we become one with ourselves, but also with the environment and the people around us. We become the peaceful beings that we were created to be. We seek meaning and purpose over material things and focus our attention on who we are meant to be rather than who others want us to be.



How do we connect to our spirituality?

The way that we connect to our sprituality is through the experiences that our mind and body go through. It is important to recognize that our mind processes the experiences that our body goes through and feeds it to the rest of ourbody. Our mind and our body work together to shape who we are.

Because we spend 90% of our time in the built environment, our experiences in spaces have a big impact on our lives. These experiences can aid or hinder our connection to our spirituality.

In order for us to understand anything, we have to understand ourselves - to get a perception of our sense of self.

How do we experience spaces?

Humans have five main senses in which are used to understand themselves and the world around them. The visual sense has dominated over the other senses, especially in architecture. If only one sense is being used, how much is the human experiencing? Design should interact with a collaboration of senses to enhance experiences. When we enter a space that gives us opportunities to touch different textures, taste different foods, smell different scents, see different sights and hear different sounds, we become very engaged and we can find ourselves becoming one with our surroundings. We start to learn more about ourselves and the things that we like and dislike.

Senses create experiences | Experiences shape reality.

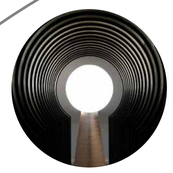
Spaces are experienced through the senses. Sensual qualities of architecture have been forgotten. There are different qualities of a space that help individuals perceive a space. Such qualities are textures, volumes, materials, temperature, scents and sounds. This is what should give individuals a complete multi sensory experience and help people learn more about themselves, their environment and other people as well. With the use of other senses, new perspectives arise along with more absorption and awareness of surroundings.

SENSES & SPACES

Imagine a space where the sounds are repetitive and help you focus on you.

Imagine smelling something that reminds you of your favorite memory.

Imagine tasting the crisp air gliding against your skin.



Imagine that there is one light source and it helps you see yourself rather than see the space around you.

Imagine walking into a space barefoot. The temperature of the floor, the texture and the noise can bring you closer to your core.

Men go abroad to admire the heights of mountains, the mighty waves of the sea, yet pass over the mystery of themselves without a thought.
-St. Augustine

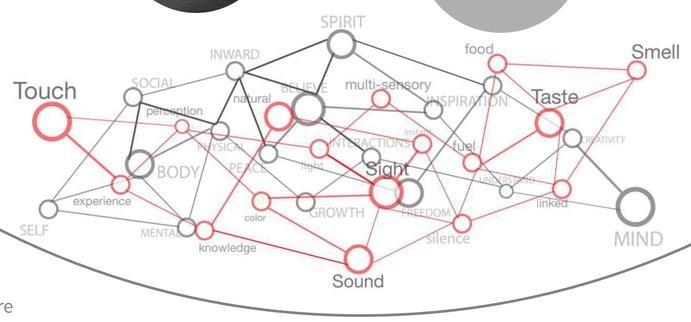
Mind

The way we come to know ourselves is through the people around us and the environment we are surrounded by. An exchange between oneself and the environment, oneself and another and oneself with his/her spirit is necessary for one to get an understanding of who they are. Humans are not made alone.

Spirit

Body

The way spaces feel, the sound and smell of these places has equal weight to the way things look.
-Juhani Pallasmaa



Self

Others

Environment

What is the problem?

With a dominance of the visual sense, people are losing connection with themselves. If one sense is predominantly used, that experience is limited. There is so much to learn about the world and about one's self. Design can encourage the use of all of the applicable senses and encourage a deeper connection to one's spirituality.

The problem today is that there aren't too many spaces that encourage spirituality because of the distractions of the visual sense. If our eyes are constantly wondering, we limit the time that we spend pondering. Being in touch with our spirituality requires thought. It requires experiences that challenge us to learn more and grow - to grow as spiritual beings. As humans, we are so powerful, and if we can use this power with love of self, love of neighbors and love of environment, we can create a better future.

Appreciation is not just thought, appreciation is perception. Perception, through our senses, is important to differentiate from thought and language. We need to notice things to appreciate them. We register consciously only a small percentage of what we perceive. We learn to filter; we learn what is important and tend to disregard the rest. To build appreciation it is critical to adjust our filters so we perceive more, what makes us feel good, and not just what we need to know to survive.

Be ONE with YOURSELF

Be ONE with OTHERS

What is the solution?

Spaces should invite people to look into the world, not just with their eyes, but with their whole body. Spiritual spaces that are designed so that the user is inspired to feel, hear, smell and taste will encourage the suppression of vision. When the architectural experiences are more than just visual perceptions, the user unites with the space and the environment, thus leading them deeper into their spirituality. "Good and thoughtful design can not only awaken our senses, but reconnect us to place and to ourselves." -David Darling

The solution is to provide a setting where people can have experiences that lead them closer to their spirituality.

The Approach

By suppressing the visual sense, the other senses are invited to the experience. By using the other senses, we are learning more about ourselves. When we learn more about ourselves, we tend to reflect more and question our purpose.

It has been proven that within 20 seconds of being in nature, our heart rate decreases and we become more relaxed. If this happens within 20 seconds, without even fully experiencing a space, imagine how much more a space can impact us. Not only do our heart rates change, but also our mood and our health.

There have been recent findings in the neural systems and the complexities of the brain that highlight the impact of multi-sensory experiences to our behavior, mood and knowledge of one's self. In a spiritual space, by providing a multi-sensory environment, where the senses are introduced in a collaborative and subtle way, the user can connect to themselves rather than being distracted by their environment. The environment becomes the teacher, but the answers are all within the self.

TO ENHANCE THE EXPERIENCES OF SPIRITUAL SPACES

Individuals' Visual Attention to Interior Elements in the Audio-visual Context of the Lived Experiences

Jain Kwon, PhD, *University of Georgia, USA,* & **Juyeon Kim***, PhD, *Soongsil University, Korea* **Corresponding author: kjy@ssu.ac.kr*

ABSTRACT

Sensory experience in built environments is highly complex, and the multimodality of human perception plays a crucial role in interior occupants' spatial experiences. This study explored how visual attention to the interior elements of commercial settings was affected by auditory stimuli, involving eye-tracking experiments and semi-structured interviews. The participants consisted of 13 females and seven males (ages 19-23). Three photo images of coffee shops were used as visual stimuli (Figure 1). For data collection, a SMI-iViewRed eye tracker (with a sampling rate of 30 Hz) was integrated into a high resolution 27-inch 1920x1080 pixels widescreen monitor. As auditory stimuli, two songs in different genres were used: soft pop (music 1) and dance-pop (music 2).

Each experiment was conducted through the following procedures: 1) each photo was displayed on the monitor while the two songs played consecutively, for 60 seconds/music and with a 10-second break in between songs; 2) this procedure was repeated three times, paired with the three images displayed in a random order; 3) a 20-minute, semi-structured interview followed. To determine fixation count and dwell time, each 60-second associated with one music was broken down into six 10-second segments (from T1 to T6); the averages of fixation count and dwell time with music 1 (M1) and with music 2 (M2) were compared. To sufficiently explain the details, this abstract illustrates specifically the findings from data analysis using image 1.

Figure 1. Visual stimuli for eye-tracking experiments (from left, coffee shop images 1, 2, & 3)

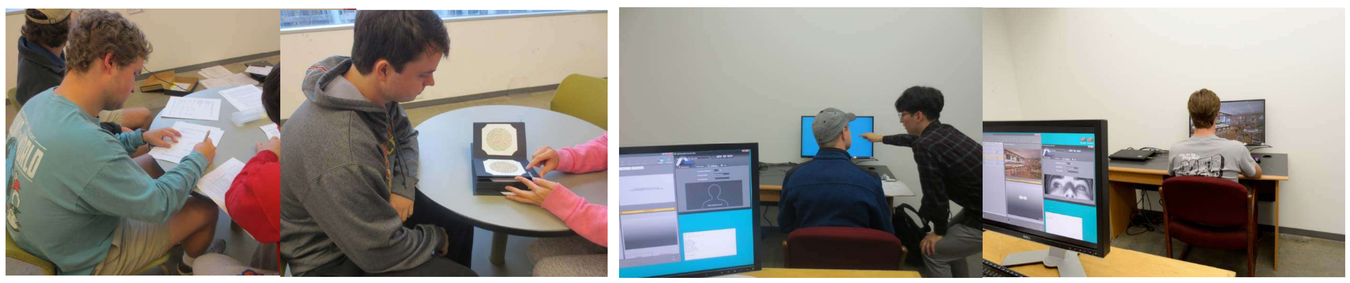
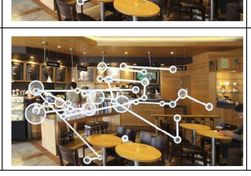
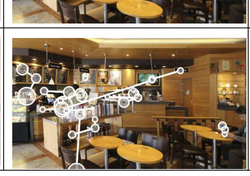
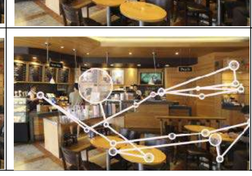


Figure 2. Procedures of participants' eye tracking experiments

The averages of fixation count (FC) and those of dwell time (DT) showed the opposite patterns from each other: e.g., FC-M1 lower than FC-M2 in T1, T3, and T6 while DT-M1 higher than DT-M2 in the same T-segments. The averages of fixation count (FC) per AOI with M2 appeared higher than with M; FC, DT, FC per AOI, and visual attention count showed little differences between M1 and M2, particularly in T2 (Figure 2 and 3). The fixation frequency averages by T-segment showed little differences, except in T6— significantly higher with M2. Fixation duration with M2 were longer in T5-T6 and shorter in T1-T4 (Figure 4). Despite the individual differences of scanpaths, general patterns were also found: with M1, sparse distributed fixations; with M2, densely distributed fixations, higher fixation count, and longer dwell time (Table 1). The participants gave their visual attention to the overall interior elements while slow and soft music was playing; their visual attention to signs, objects, and retail elements was noticeable while fast and intense background music was playing. The findings from the semi-structured interviews provide explanations of the various influences on and motives for such patterns and specific attentions.

Table 1. *Exemplary comparison of the patterns of two individuals' fixation sequence, with M1 versus with M2 in the first 10-second segment (T1)*

	Participant 1 (P1)		Participant 2 (P2)	
	with Music 1 (M1)	with Music 2 (M2)	with Music 1 (M1)	with Music 2 (M2)
T1				
T2				
T3				
T4				
T5				
T6				

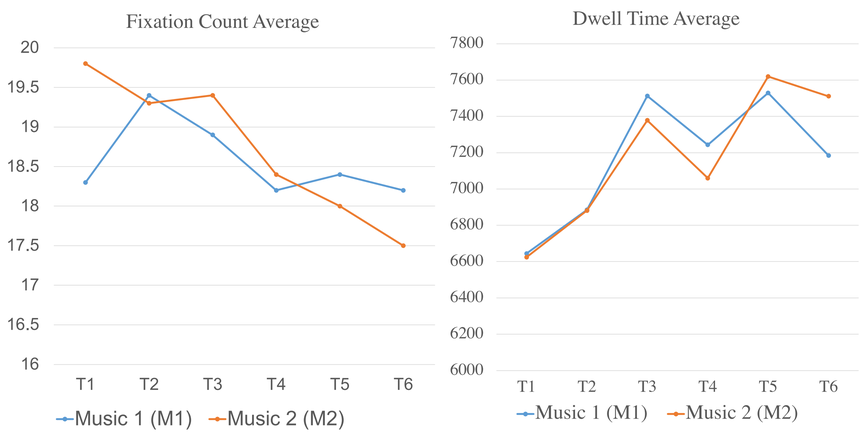


Figure 3. Comparison of the averages of fixation count and dwell time – with M1 versus M2

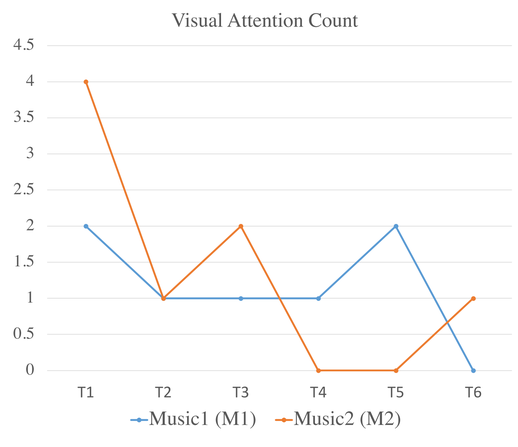


Figure 4. Visual attention count (highest 10% of the data) in category I – with M1 versus M2

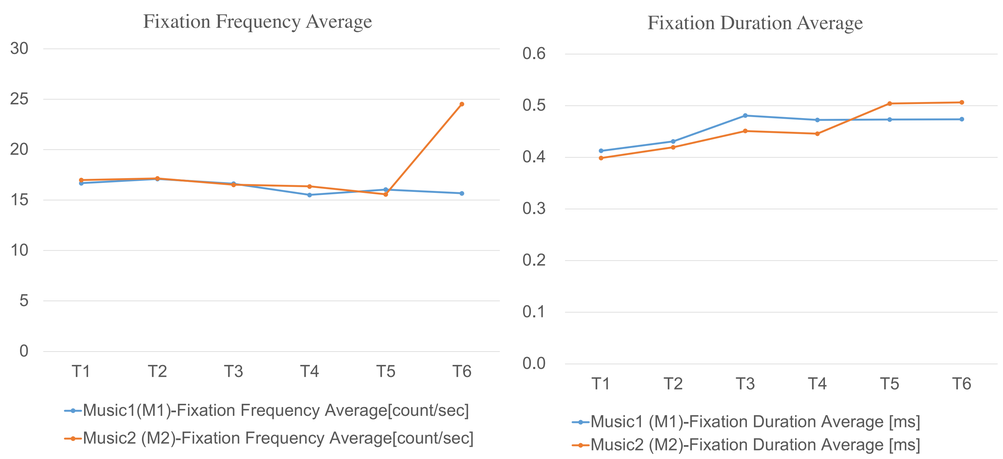


Figure 5. Comparison between M1 and M2: Fixation frequency and fixation duration

Acknowledgement

This work was supported by the National Research Foundation of Korea(NRF) grant funded by the Korea government(MSIP)(No. NRF-2017R1A2B2007276).

Color Contribution to Environmental Legibility

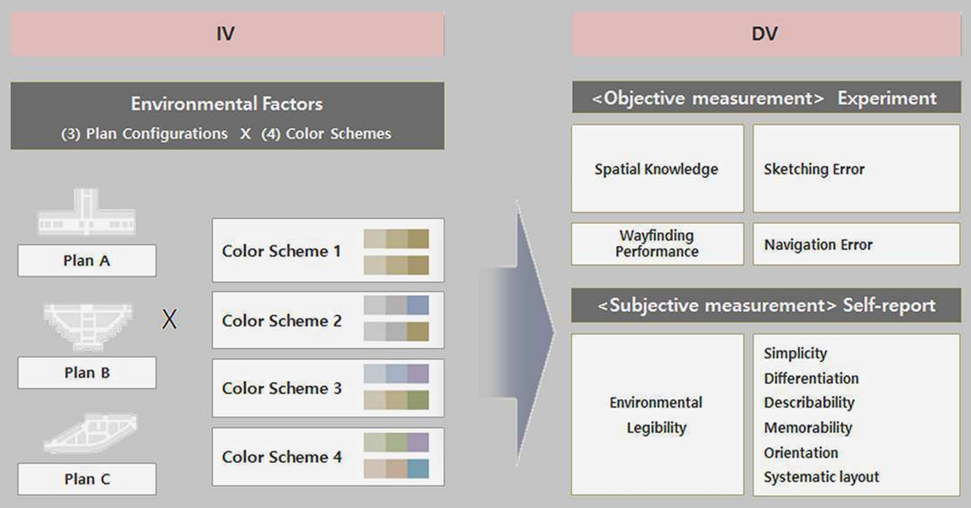
: Relations of Objective Performance and Subjective Perception in Wayfinding

Young-Hee Min & Mi-Kyoung Ha
Dept. of Interior Architecture and Built Environment, Yonsei University.

ABSTRACT

A large-scale indoor environment cannot be recognized at a single vista, and navigation requires more abstract understanding of spatial interrelationship (Peponis, Zimring, & Choi, 1990). Spatial knowledge is hierarchically acquired with the information of landmark, route, and topological layout (Siegel & White, 1975; Tversky, 2000). Recent neuropsychological evidences show that spatial cells in hippocampus react to the specific location in place cell, orientation in head direction cell, at regular distance in grid cell, and spatial edges in boundary vector cell (Hartley et al., 2014). To understand complex built environment, we conceptualize and categorize spaces according to the equivalence and distinctiveness of environmental attributes, however cognitive effects of environmental colors are largely unknown (Arthur & Passini, 1992). Using the contrast of environmental colors, this research aims to investigate the correlations of objective and subjective color contribution to wayfinding and environmental legibility. Through wayfinding experiments in the virtual environment with twelve different scenarios (three plan configurations * four color schemes), sketching errors and navigation errors were measured as objective performances. After the experiment, subjects fulfilled self-report about the virtual environment they experienced. These subjective measures included the perceived environmental legibility and color contribution to wayfinding. By examining the correlations of objective performance and subjective assessment, how the level of color contribution was engaged the unconscious and conscious level in subjects' minds is investigated.

METHOD



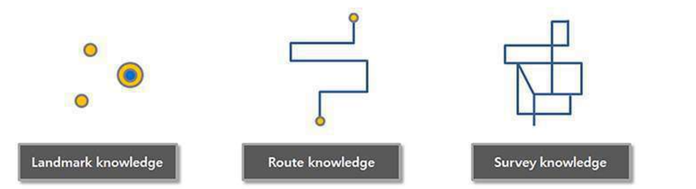
Acknowledgements

This academic event was supported by the Yonsei University Research Fund of 2018(2018-12-0093).
This research was supported by Basic Science Research Program through the
National Research Foundation of Korea(NRF) funded by the Ministry of Education
(NRF-2017R1D1A1B03033386).

Contact. Young-Hee Min, Ph.D. aranciata02@gmail.com

A. Objective Performance

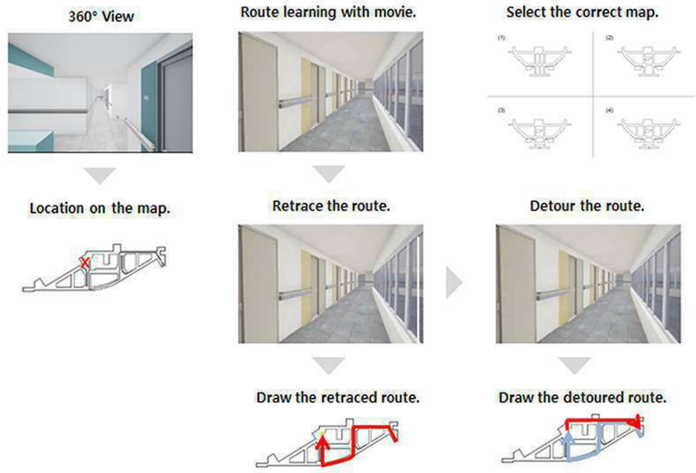
1. Spatial Knowledge Acquisition (SE: Sketching Error)



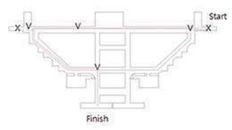
Identifying one's own position and relevant navigational choice points

Procedurlal knowledge, connecting distinguishable landmarks

Configurational knowledge, integrating routes and guides high-level decisitions for route selection and general direction



2. Wayfinding Performance (NE: Navigation Error)



Time
Average Speed
Redundancy
Hesitations
Backtrackings
Wrong turns

$$Std.W_t = \frac{W_{tx} - min.W_t}{max.W_t - min.W_t}$$

Standardize the variables from 0 (the best result) to 1(poorest result), and Navigation error can be an average of these variables.

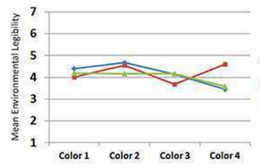
B. Subjective Perception

Table. Questionnaire items of legibility (from 1: strongly disagree to 7: strongly agree)
*** Negative items were scored as 1->7, 2->6, 3->5, 4->4, 5->3, 6->2, 7->1.**

	Items	Description	(+/-)*
EL	1. Simplicity	The spatial structure and layout was simple and easy.	(+)
	2. Describability	I can describe this space to others easily.	(+)
	3. Differentiation	I could not figure out the difference between a space	(-)
	4. Orientation	I could not orient myself to the destination easily.	(-)
	5. Memorable structure	I could easily remember the structure and layout of the space.	(+)
	6. Memorable scenes	I could easily remember the spatial elements and scenes.	(+)
	7. Systematic layout	The spatial layout was systematic and easy to understand.	(+)
CC	1. Differentiation	Colors helped to differentiate repetitive zones.	(+)
	2. Configuration	Colors helped to understand the spatial structure and layout.	(+)
	3. Orientation	Colors were helpful for spatial orientation	(+)

RESULTS & DISCUSSIONS

1. Environmental Legibility



ANOVA
- Main Plan Effects
  -> Not significant
- Main Color Scheme Effects
  -> Significant ($p < .05$)
- Plan X Color Interaction Effect
  -> Significant ($p < .05$)

In perceiving environmental legibility, there were significant main color effect and interaction effect of color schemes and plan configurations ($p < .05$). This means color schemes affect legibility and it differs to the geometries of plan configuraitons.

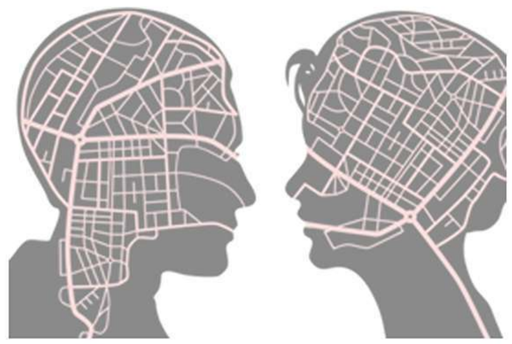
2. Correlations

Table. Pearson correlations (r) between objective and subjective measures

		Objective Performance		Subjective Perception	
		SE	NE	EL	CC
Objective Performance	SE	1	.239**	-.280**	-0.074
	NE		1	-.189**	-.281**
Subjective Perception	EL			1	.362**
	CC				1

NOTE * $p < .05$, ** $p < .01$.

There were significant, yet very weak correlations between sketching/ navgigation error and environmental legibility perception ($p < .01$). However, the perceived color contribution was significantly correlated with navigational error only.
Color schemes contributed both to objective performance and subjective perception, and these two measures significantly correlated each other except acquiring multidimensional spatial knowledges. These results indicate very weak correlations of objective performance and subjective perception.



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Contributed Posters #3
Friday, September 21st | 2:30 – 3:30 PM

Davide Ruzzon, TUNED Lombardini22 / Milan, Italy
How Architectural Settings of Interior Spaces Can Enhance Users' Experience

Elisabetta Canepa, Polytechnic School, University of Genoa / Genoa, Italy
Neurocosmos: The Emotional and Cognitive Correlates of Architectural Atmospheres

Skantzi Rengina-Theodora, Technical University of Crete / Crete, Greece
Architecture, Psychology and Cognitive Functions in Confined Spaces. Comfort, Appropriation and Habitability

Dana Oprisan, Biophilic Practice Group in Washington, D.C. / Washington D.C.
Shaping the Human Biosphere: A Systematic Review of Research on Visual Attributes of the Built Environment and Their Applicability in Architectural Practice

John Shoaff, John H. Shoaff, Architect / Fort Wayne, Indiana
How Frank Lloyd Wright Used Fundamental Mechanisms of Perception to Generate His Uniquely Powerful Aesthetics

Evgeniia P. Petrashen, Saint-Petersburg State University / St Petersburg, Russia
Strengthening the Physical and Mental Health of Children Means of Environmental Design: The Method of Forming a Therapeutic Landscape

Yoko Kawai, Yale University, School of Architecture / New Haven, CT
Blurring the self/space boundary to increase mindfulness: perspectives from Japanese architectural philosophy, neuroscience and psychology

Sarah Petrocelli, Prospect Design / Brooklyn, New York
Cognitive Architecture: A Model for Professional Practice

Judy Theodorson, Washington State University / Pullman, Washington
Ambiance in Spiritual Spaces: Examination of Themes of Light and Nature in Student Design Proposals

Martha Espinoza, Sciences, Kyushu University / Fukuoka, Japan
Exploring Garden Design Composition and its Effect on Psychophysiological and Behavioral Responses

Melissa Marsh, PLASTARC / Hastings-On-Hudson, New York
Mind and Matter: Multi-Sensory Office Design in the Wellness Era

Kynthia Chamilothori, Ecole Polytechnique Fédérale De Lausanne (EPFL) / Switzerland
Perceived Interest and Heart Rate Response to Façade and Daylight Patterns in Virtual Reality

Signo Uddenberg, MKThink / San Francisco, California
The Benefits of Thermal Sequence & Variation on Comfort

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TUNING DESIGN

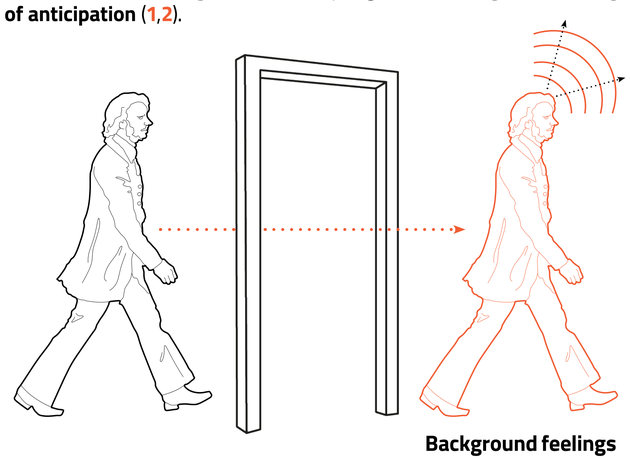
How Architectural Settings of Interior Spaces Can Enhance Users' Experiences

Lombardini22 S.p.A.
Lombardini22, a leading group on the Italian architecture and engineering scene, operate internationally through three brands: L 22, specialising in architectural design and engineering for the Retail, Office, Hospitality and Data Center markets; DEGW, a leading company in strategic consultancy about work methods and interaction between physical space and corporate performance; FUD Brand Making Factory, focusing on Physical Branding and Communication Design.
Lombardini22 is now a workshop employing over 160 people, a dynamic and creative workplace, which is the fourth-ranked architecture firm in Italy in terms of turnover.

Davide Ruzzon
Tuned Scientific Responsible, Architect, graduated from IUAV in Venice.
Scientific Responsible of the NAAD Master 'Neuroscience Applied to Architectural Design' at the IUAV University of Venice.
Director with Sarah Robinson and Alessandro Gattara of the new architecture magazine 'Intertwining' for Mimesis International. Author with Vittorio Gallese of 'Tuned Architecture' for 2016 Overview Publisher Padova and of 'The architecture of differences' for TArch Edizioni 2013 Padua.
He has written and edited collections of essays, coordinated the editorial board of Anfione and Zeto and organized seminars and conferences. He has carried out public and private construction projects and participated in International Competitions.

01/

Inside the different places in the city, every human experience involves the **"system of seeking"**, from which spring **several background feelings of anticipation** (1,2).



Background feelings

02/

There is an intertwining among the Phenomenological Essence of the human experiences **PE** in interior spaces, the Sensori-Motor Programs **SMP** and the Background Feelings **BF** (9,10,13).

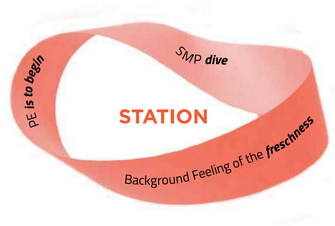
/ SCHOOL
PE *is to grow* - **SMP** *jump*
Background Feeling of *lightness,*

/ HOUSE
PE *is to restore* - **SMP** *lie down*
Background Feeling of *relaxing,*

/ TOWN HALL
PE *is to belong* - **SMP** *hug*
Background Feeling of *warmth,*

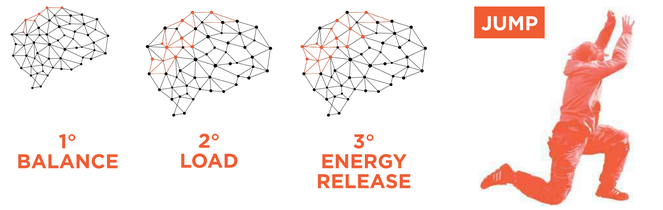
/ HOSPITAL
PE *is to regenerate* - **SMP** *stand up*
Background Feeling of *surging,*

/ OFFICE
PE *is to create* - **SMP** *dance*
Background Feeling of *excitement.*



03/

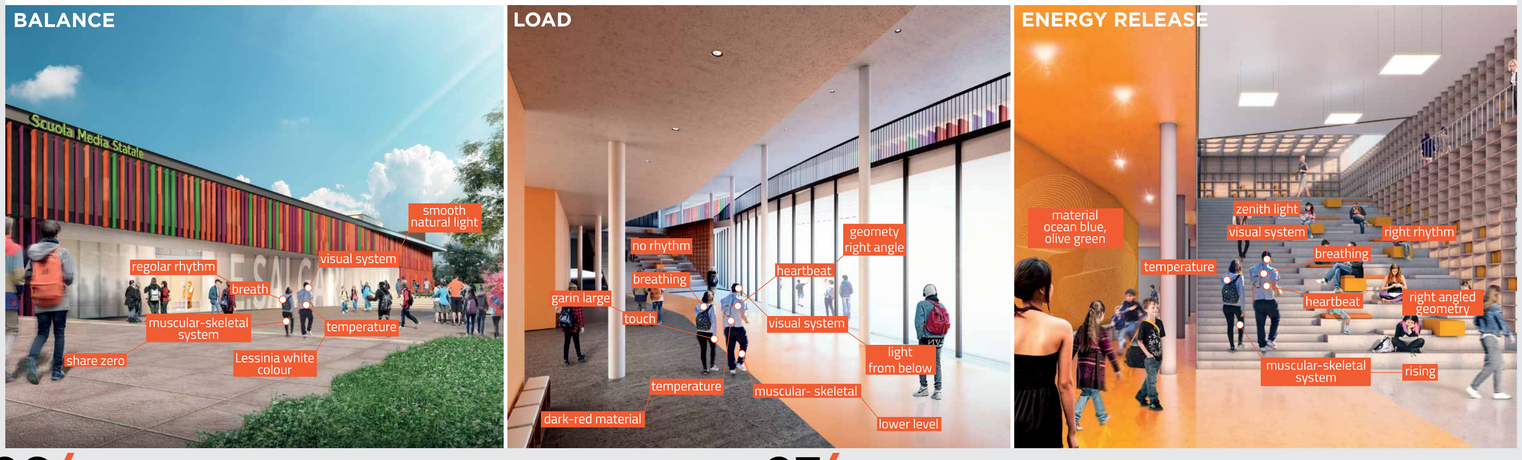
Along the evolution, each body gesture created cortical maps featured by their particular relationships with space, by their development phases in the time, and by the flow and direction of the light perceived.(3,4,5,6,7,11).



CLIMB DIVE RELAX

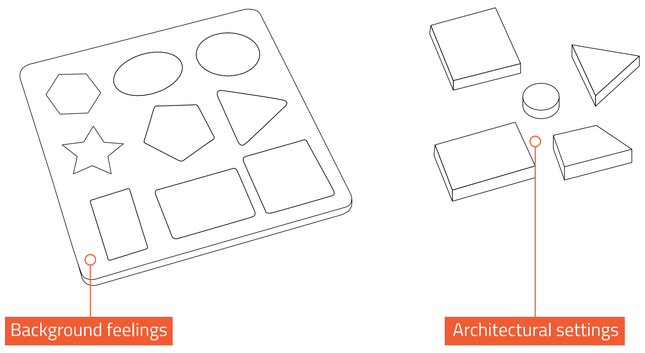
04/

An architectural setting (of a particular topology, geometry, proxemics, lighting, or rhythm) can activate analogous signals belonging to a specific sensorimotor program, involving proprioceptive, vestibular, and visual dimensions (12,15). Negrar School.



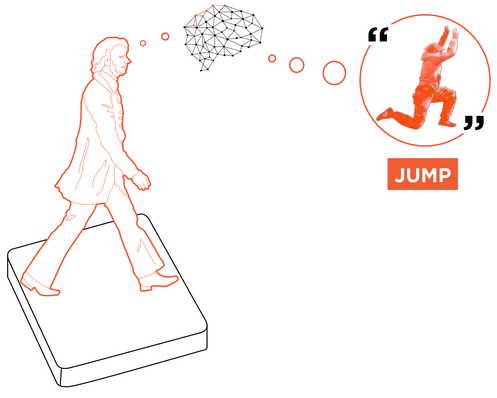
05/

Organisms are driven by evolution to seek quicker and more efficient ways to attain homeostasis. The awaited emotion or background feeling acts as a filter and catalyst. It encourages the recognition and selection of architectural environments able to embed emotional, sensorimotor, and visual components proper to the bodily gestures related to the awaited emotion (12,14,15).



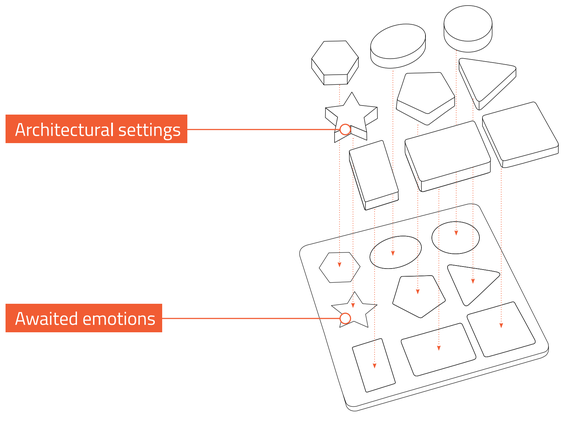
06/

Within the experience of a particular place, this bodily perception enacts (through the process of embodied simulation) the gesture associated with the anticipated feeling. This coupling - the "nesting mechanisms" regulated by more ancient parts of the brain - focusing the attention enhances cognitive processes, and produces wellbeing (10,12,14,15).



07/

This recognition of bodily gestures is transformed into an attunement of input signals from the environment with output elements of memories related to the anticipated feeling (12,15).



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12. **Davide Ruzzon, Vittorio Gallese**, *Tuned Architecture*, 2016;
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Neurocosmos.

The Emotional and Cognitive Correlates of Architectural Atmospheres

ANFA Conference

The Academy of Neuroscience for Architecture

**20.SEP —
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INTRODUCTION

The increasing process of aestheticization of reality in the present society, from production to politics, has fueled the interest in the atmospheric dimension, as a catalyst for aesthetic experience. We are living a real 'atmospheric turn'.[1]

The atmospheric experience springs, immediately and synthetically, from an emotional resonance with the environment – built or natural – by which the human action is surrounded. Atmosphere is «not simply a space but a combination of space and activity – something produced by the people within the space».[2] The point of view is subjective. It is not a subjective matter of opinions, but a sensual subjectivity intrinsically attached to the sense of time and place. This survey drifts to a subpersonal level of explanation, set up on biological elements, observable with a neuroscientific approach. Human beings are dynamically influenced by their growing social and cultural context, but come into the world genetically determined. «The brain, the body, and the environment are in effect codetermining of each other and therefore coevolving».[3]

THE EXPERIMENT

Background and Aims

Through its inherent spatial presence, the architectural action instills an emotional potential in the physical environment, shaping the ground for the architectural atmospheric perception[4]. The term 'atmosphere' defines a state of resonance and identification (sensorimotor, emotive and cognitive) between an individual and his surrounding built space. Human subjects can feel empathy for inanimate rooms when they interiorly establish an embodied simulation[5] of some architectural features as form, proportions, rhythm, materials, light and shade, temperature, sounds (that is the so-called 'generators of atmosphere'[6-7]).

Performing an experimental test, we propose to verify the existence of an empathic reactivity in subjects put into contact with architectural settings, loaded by variable arrangements of atmospheric tension. The aim is to determine which architectural features ignite the atmospheric perception, based on emotional sensitivity, and if this supposed empathic performance is shared among subjects and gradable as model in architectural theory – according to the scientific principle of objectivity and replicability.

Materials and Methods

The test was based on observation of reproductions of architectural settings designed about their atmospheric skills. These settings, modelled in VR, were showed to engaged subjects, who had to draft a self-assessment questionnaire, aimed at analyze the multicomponential nature (emotive and cognitive) of the architectural atmospheric perception. The sample was founded on 205 individuals, of mixed sex, aged 20-35 and collected from the same socio-cultural milieu. Their dispositional empathy was preliminarily examined by a brief form of the *Interpersonal Reactivity Index* (B-IRI).[8] Every experimental session employed a series of 21 digital settings, composed by a standard element (*baseline*) and 20 variations on the theme. The case study was the spatial unit of corridor[9], inflected with 5 categories of design parameters: each one was composed of 4 subcategories (see images below). In the questionnaire the first questions rated the subjective measure of the atmospheric emotive component, using a self-report visual analogue scale (VAS), based on *arousal* and *hedonic valence*. Following questions explored the cognitive dimension: we asked the participants to describe with an adjective the emotional experience lived, extracting a tag from a prearranged set of 'atmospheric features' (emotive qualities)[10] and 'objective features' (physical and geometrical properties).

Results

	Architectural conditions					
	baseline	category 1	category 2	category 3	category 4	category 5
arousal	4,37 ±1,73	5,96 ±1,29	6,53 ±1,23	5,83 ±1,17	6,32 ±1,15	7,07 ±1,05
valence	4,70 ±1,44	4,57 ±1,06	4,90 ±1,23	5,69 ±1,11	5,28 ±1,28	6,74 ±1,11

Table 1: Mean subjective evaluation ± standard deviation (*arousal* and *valence*) of stimuli in the different categories

Regarding *arousal*, statistical analysis showed that the 'condition' factor is significant (F(5,1020) = 168,770 / p: 0,0001). Post-hoc analysis showed that all the categories are significantly different from each others (p always < 0,004), except for cat. 2 which is not different from cat. 4 (p = 0,07). Precisely: baseline received the lower scoring, followed by cat. 3, cat. 1, cat. 4 and cat. 2. Finally, cat. 5 received the highest scoring (Figure 1). Furthermore, statistical analysis showed also that the significance of 'condition' factor is influenced by gender (F(5,1010) = 2,715 / p: 0,019), but not by age (F(5,1010) = 1,605 / p: 0,15). In particular, post-hoc analysis showed that gender influenced significantly only cat. 4 (p: 0,045), with females who gave a higher scoring (6,45 ±1,20) than males (6,13 ±1,05), as showed in Figure 2.

Also for *valence*, statistical analysis showed that the 'condition' factor is significant (F(5,1020) = 133,586 / p: 0,0001). Post-hoc analysis showed that also for *valence* all the categories are significantly different from each others (p always < 0,02), except for cat. 2 which does not differ from baseline (p = 0,23). In details: cat. 1 received the lower scoring, followed by baseline, cat. 2, cat. 4 and cat. 3. Finally, cat. 5 received the highest scoring (Figure 3). Regarding the effect of age and gender, also for *valence* the significance of 'condition' factor is influenced by gender (F(5,1010) = 5,642 / p: 0,0001), but not by age (F(5,1010) = 0,559 / p: 0,73). Notably, post-hoc analysis showed that gender influenced significantly baseline (p: 0,019), cat. 1 (p: 0,013) and cat. 4 (p: 0,043). In baseline condition males gave a higher scoring (5,00 ±1,50) than females (4,50 ±1,37); also in cat. 1 males gave a higher scoring (4,80 ±0,99) than females (4,41 ±1,08); on the contrary, in cat. 4 females gave a higher scoring (5,48 ±1,30) than males (5,00 ±1,22). See Figure 4.

At the level of cognitive analysis, when all the subcategories were compared with baseline, evaluated 'not atmospheric' by 64% of the sample, it emerged that the number of atmospheric adjectives attributed to cat. 1 and to cat. 5 was not different from baseline (p always > 0,05). Regarding cat. 2, two subcategories resulted less 'atmospheric' than baseline. On the contrary, all the cat. 3 and cat. 4 subcategories were evaluated significantly more 'atmospheric' than baseline (p always < 0,0001).

Finally, it was observed that there is a statistically significant correlation between the B-IRI values and those of *arousal* (cat. 1, cat. 2, cat. 3 and cat. 4) and *valence* (cat. 3 and cat. 4). They were always direct correlations (as B-IRI scoring increases, the *arousal* or *valence* one also increases).

FIGURES

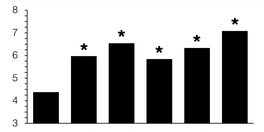

Figure 1: Arousal mean scores.
★ significantly different from baseline

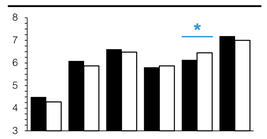

Figure 2: Arousal mean scores
adding gender as covariate.
■ males
□ females
* gender significantly influencing

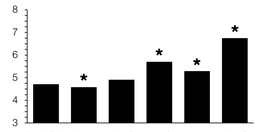

Figure 3: Valence mean scores.
★ significantly different from baseline

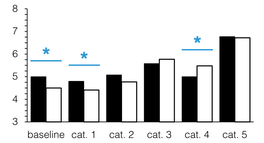

Figure 4: Valence mean scores
adding gender as covariate.
■ males
□ females
* gender significantly influencing

CONCLUSIONS

The significance of the experiment performed lies not in the single and partial results obtained, but in the overall process. It suggests the real opportunity to study the atmospheric perception (as an expression of architectural experience *tout court*) by a neurobiological investigation. The experimental method tested has proved to be scientifically valid and applicable in architectural research as model to detect emotional and perceptual mechanisms. The cognitive analysis should be reviewed. We contemplate validating the results here collected with neurophysiology and/or functional neuroimaging techniques.

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The atmospheres box hosted all experimental sessions

Inside the atmospheres box during a VR test session

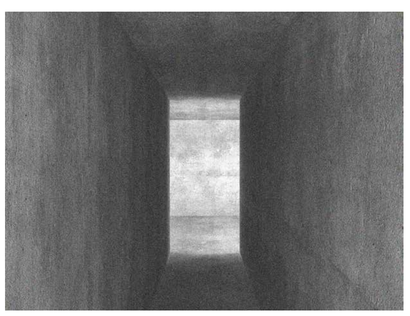
Standard element

0 baseline

Typical corridor
in private
residential buildings

Width: 1,20 m;
height: 2,70 m.

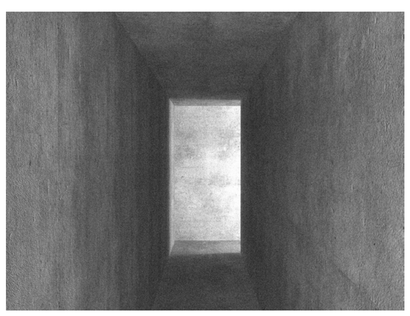
With smooth finished
concrete walls,
floor and ceiling.



**Variation
of plan layout**

1 category

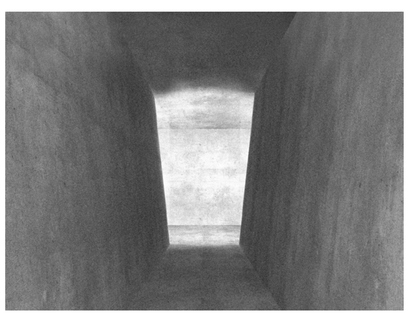
Case no. 1.2
*'L' layout
with right-turn.*



Variation of section

2 category

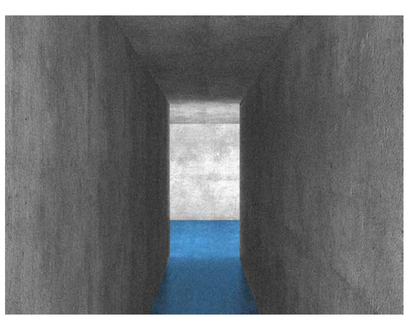
Case no. 2.4
*Trapezoidal section
with sloped walls.*



**Variation of horizontal
surface treatment**

3 category

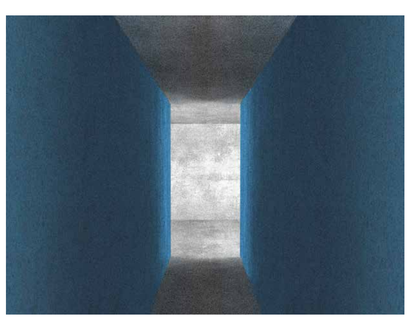
Case no. 3.1
Colored flooring (blue).



**Variation of vertical
surface treatment**

4 category

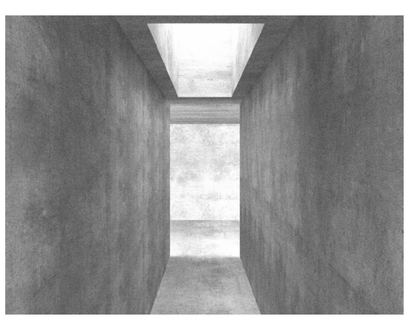
Case no. 4.1
Colored walls (blue).



**Variation of light
and shade layout**

5 category

Case no. 5.1
*Zenithal
and scattered lighting.*



Ambiance in Spiritual Spaces

Examination of themes of light and nature in student design proposals

Judy Theodorson, M.Arch, Associate Professor, Washington State University

This research is concerned with ambiance in spiritual spaces. For the purpose of this abstract, ambiance is described as spatial and sensory qualities that shape a phenomenological experience. In the broadest of terms, spiritual spaces embody the metaphysical to deliver a higher order experience. Such experiences vary widely, ranging from a sense of connection, to a quiet moment of contemplation, to enlightenment. From a neurological perspective, the goal could be described as reseting one's mental and/or emotional state.

The method for exploring ambiance in spiritual spaces is to analyze conceptual design proposals produced for a 2018 IDEC Interior Design Student Competition titled Fundamental Atmospheres: Designing for Spatial and Spiritual Experiences.* The brief was purposefully broad, asking student designers to provide for the empowerment of users to grow intellectually, spiritually, mentally, or metaphysically. The program could be a religious practice (traditional or emerging), a secular space of reflection or mindfulness, and/or places for commemoration. The students were to define the specific use and to develop an atmospheric intervention. Furthermore, they were encourage to engage experiential and primary research methods and to use light as a material of design.

The top 25 projects (out of 155) were examined to uncover the presence and potency of two architectural themes that link ambiance to known neurological outcomes: light and nature. The human relationship to light is partially biological: humans are drawn to light and fear the dark. Moreover, daylight is critical in regulating our circadian system and therefore our well-being, performance, and mood (Edwards & Torcellini, 2002). More significant to spiritual spaces is the aesthetic and transformative powers of light, described by Plummer (1992) as "almost magical" with the capacity to endow "material form with the wholly immaterial force of the human spirit" (p.19). Over history of architecture, light has played a critical role in spiritual spaces, a transforming ambiance that serves as a conduit to divinity or a shift in mood / consciousness. The nature theme includes a wide array of sensory inputs including air movement, thermal variation, natural light, water and plant features, and natural materials. Exposure to nature is widely accepted as beneficial to human neuro-function, a calming influence in a modern world of cognitive overload. Theoretical foundations include the "biophilia hypothesis" which establishes that humans have the urge to affiliate with other forms of life (Wilson, 1984); furthermore, Wilson describes nature as holding the" key to our aesthetic, intellectual, cognitive and even spiritual satisfaction." Kaplan's (1995) Attention Restoration Theory (ART) suggests that certain nature experiences are restorative in that they support concentration, leading to recovery from mental fatigue.

The value of examining student proposals is to understand the processes and inputs students use in developing the ambiance of spiritual spaces. Ultimately, the data extracted from the student proposals confirms the existence and potency of light and nature themes; they were prominent in more than 75% of the projects. Did the students arrive at this direction experience, intuition, and/or evidence? Did they uncover the neurological connection? Most of the students did engage in traditional research such as precedent, evidence-based design, and theoretical foundations. Surprisingly, a minority of the students engaged in meaningful experiential research despite the fact the most of the projects aimed to achieve an experiential space. This suggests a disconnect between traditional and phenomenological methodology. On the other hand, many of the renderings indicate rich atmospheres of light and nature and materiality and nearly all of the top selections show humans in some sort of contemplative pose; this indicates the students understood how to produce an abstract representation of ambiance.

While several of the projects had a specific program (teahouse, community kitchen, spa, experiential art gallery), most aimed for a non-defined meditative space with multiple use options. What differentiates a "meditative space" from a multi-use space is a sense of ambiance. In these projects, the ambiances was produced by integrating aspects of light, nature, and / or water, and a spare palette of natural materials. This suggests a future direction for interiors, one that finds aesthetic and neurological value in the light-nature ambiances for a variety of interior programs.

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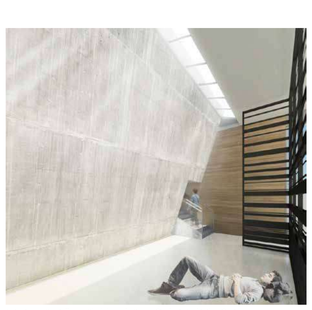
*the author was the co-author of the competition

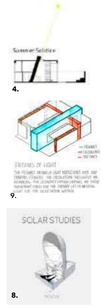
light

collecting light

Many spaces are designed to collect and distribute natural light; ideas include filling interiors with light and inviting human use. Design investigations range from massing models to diagrams to digital solar studies. Design precedents include buildings such as the Pantheon.

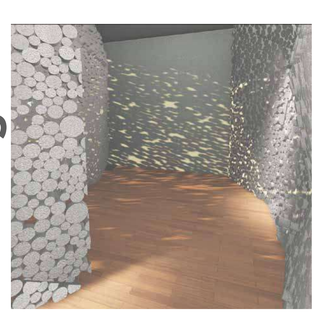


4.Kirsten L. Montalbano, Virginia Tech: *Yugen Student Meditation Center*



filtered light

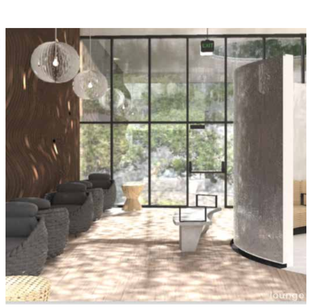
Inspired by clouds, forests, and light reflecting off water, several projects sought to create ethereal ambiances by filtering or modifying light. This was also a topic found in readings on spiritual light. Physical modeling with materials and light are the primary methods for design exploration.



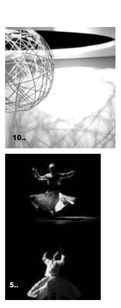
2. Sarah Morgan Nix, Montana State University: Inhale Exhale Spatial Textile Design

patterns of light + dark

Several projects emphasized the relationship of light and dark and our attraction to light movement and shadow patterns. Inspirations include dappled light in nature, dance, and poetry in addition to readings by light experts and visits to precedents such as the Holocaust Museum. Methods for exploration include physical models and digital representation.



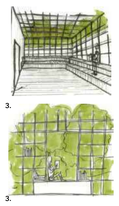
10.Dana Calinisan, British Columbia Institute of Technology: YUME



nature

interior landscapes

A number of projects intentionally blurred the boundaries between interior and exterior by treating vegetation as a primary interior spatial material. Other projects seamlessly integrated courtyard and interior.



7.Alexandrea Sosalla, University of Minnesota: Reflectera

biophilia

Biophilia theory and patterns were often cited as support for bringing people and nature into contact. Experiential research included journaling and photography in natural setting where students discovered beauty in patterns of nature and pleasure from sensory stimulation.

1. Alyssa Garvey, Endicott College: Field of Flowers

well-being

Empirical research studies formed the foundations for the thesis that nature = health and well-being. Furthermore, experiential research from sitting in nature produced feelings of calm and seemed to clarify the mind.

3. Kelsey Muir, Virginia Tech: House of Verse: Poetry Library for Exploration of Ideas and Mindfulness

design credits
1. Alyssa Garvey, Endicott College: Field of Flowers
2. Sarah Morgan Nix, Montana State University: Inhale Exhale Spatial Textile Design
3. Kelsey Muir, Virginia Tech: House of Verse: Poetry Library for Exploration of Ideas and Mindfulness
4. Kirsten L. Montalbano, Virginia Tech: Yugen Student Meditation Center
5. Yasaman Saeidi RCC Institute of Technology: The Chamber of Light
6. Tori Palynchuk, British Columbia Institute of Technology: Perpetua
7. Alexandrea Sosalla, University of Minnesota: Reflectera
8. Sasha Weleber, Fashion Institute of Technology: The Light Observatory
9. Chloe Cudney, Kansas State University: Sacredness Among Scarcity
10. Dana Calinisan, British Columbia Institute of Technology: YUME

SHAPING THE HUMAN BIOSPHERE:
A SYSTEMATIC REVIEW OF RESEARCH ON VISUAL ATTRIBUTES OF THE BUILT ENVIRONMENT AND THEIR APPLICABILITY IN ARCHITECTURAL PRACTICE

M.Dana OPRISAN, MD, Assoc.AIA, EDAC, LEED AP BD+C

1. KEY CONCEPTS/CONTEXT

The present study is focused on identifying and synthesizing the research data addressing the impact of visual attributes - light, color, indoor nature exposure, daylight- on humans. Their use as architectural tools is correlated with the environmental quality determinants described by the main environmental psychology theories. By this, the proved impacts of light, color, indoor nature exposure, and daylight are organized by their impacts in a compelling database so they can be engaged as guidelines in architectural practice for creating spaces that meet specific human psychological needs, promote performance, productivity, well-being, and health.

2. METHODOLOGY & STEPS

- A systematic review of the studies addressing the impact of visual attributes of the environment - Light, Color, Indoor Nature Exposure, Daylight - on human psychology, physiology, health, and wellbeing was conducted. (Tabels A & B)
- The main environmental psychology theories and the space characteristics to be met based on these theories were identified. The theories are the Mystery/Complexity/Legibility/Coherence Model, the Attention Restoration Theory, and The Prospect Refuge Theory.
- The final step focused on establishing and diagraming the relations between visual attributes impacts and their role in space characteristics and quality.

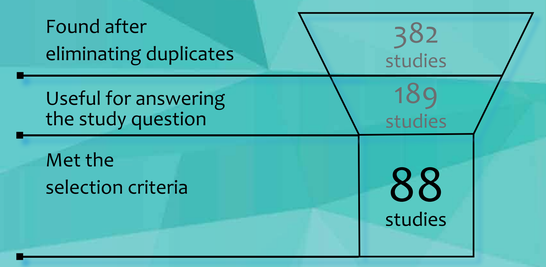
3. FINDINGS SUMMARY

The data findings are reliable and relevant for being used in architectural practice as potent tools for designing spaces with specifically intended impacts. However further research is needed especially in real environments. The light was found to be the most studied attribute, it impacts most psychological categories and is the determinant element in space perception. There is much less evidence regarding the impact of colors, and a more standardized methodology would be valuable.

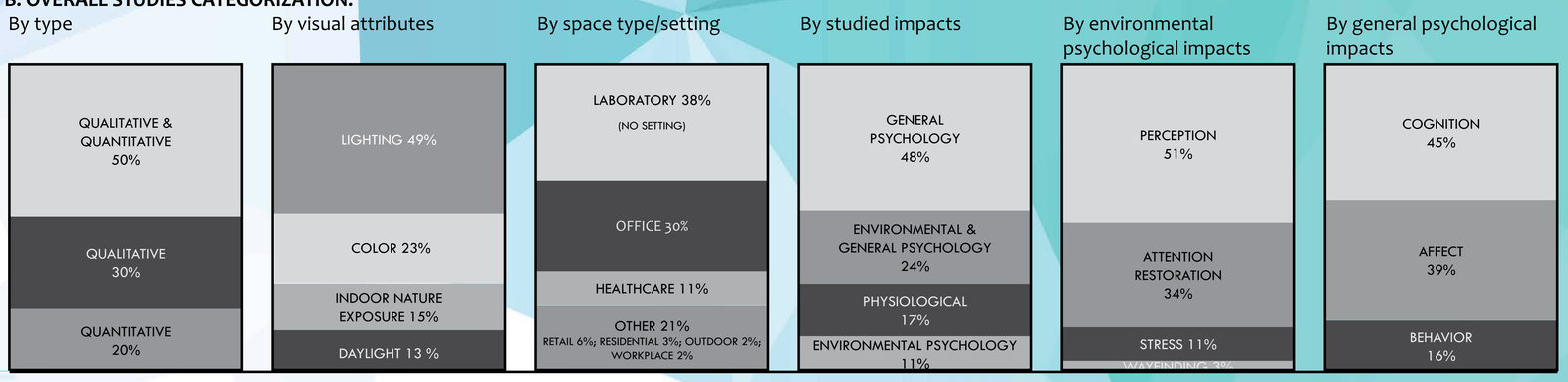
A. METHODOLOGY DETAILS

» **Databases:** EBSCO, World Wide Science, PubMed, ProQuest, Science Open, Academic Search-Complete, Architectural Science Magazine Archive, Avery Index to Architectural Periodicals

» **Studies selection criteria**: significantly relevant for the study question, employ quantitative measurements, and standardized tests, being published in peer-reviewed journals (44 peers reviewed journals, covering five disciplines: medicines, psychology, architecture and sustainability, biology and neuroscience)



B. OVERALL STUDIES CATEGORIZATION:



Any space we create is an interface between the outside world and our inner nature.

PSYCHOLOGICAL & PHYSIOLOGICAL IMPACTS OF VISUAL ATTRIBUTES

PERCEPTION & COGNITION
- Perception of the space
- Performance/Productivity
- Attention / Concentration
- Memory

MOOD & AROUSAL
- Pleasantness / Unpleasantness
- Anger / Fatigue / Arousal
- Depressed / Anxiety/ Irritability/Stress
- Excitement / Happiness / Tensenness

BEHAVIOR
- Communication/ Self-disclosure
- Seek Sensation
- Atractiveness

RECOVERY & WELLNESS
- Recovery duration
- Perceived wellness
- Absenteeism
- Workplace turnover

PHYSIOLOGICAL IMPACTS
- Sleep/Awake Axis Hormones
- Muscular Force & Velocity
- Stress Parameters: Heart Rate/Blood Pressure/ Skin Conductance/ Cortisol levels/ Growth Hormone Levels
- Visual Acuity

STUDIED VISUAL ATTRIBUTES &THEIR PARAMETERS, STUDY CONTEXT AND PSYCHOLOGICAL IMPACTS

LIGHTING

STUDIED LIGHT PARAMETERS	SPACE TYPE CONTEXT		ADDRESSED PSYCHOLOGICAL IMPACTS	
Intensity	Office	44 %	Cognition	45 %
Architectural & Task Lighting	No setting (Lab.)	33 %	Mood & Arousal	43 %
Variable and Flickering Light	Residential	7 %	Perception	19 %
CCT	School	5 %	Behavior	11 %
Illumination	Work	5 %	Attention Restoration	5 %
Monochromatic Light	Healthcare	2 %		
	Retail & Outdoor	4 %		

COLOR

STUDIED COLOR PARAMETERS	SPACE TYPE CONTEXT		ADDRESSED PSYCHOLOGICAL IMPACTS	
Cool vs Warm Colors	Office	15 %	Perception	47%
Red color	Retail	15 %	Mood & Arousal	42 %
Red vs other colors	School	10 %	Cognition	42%
Primary colors	Healthcare	15 %	Behavior	26 %
Green Color	No setting (Lab.)	55 %	Attention Restoration	15 %
Color Brightness				

INDOOR NATURE EXPOSURE

STUDIED INE PARAMETERS	SPACE TYPE CONTEXT		ADDRESSED PSYCHOLOGICAL IMPACTS	
View	Healthcare	29 %	Stress	61 %
Indoor plants	School	14 %	Attention Restoration	46 %
Artworks	Office	14 %	Cognition	46 %
	Retail	7 %	Perception	23 %
	Virtual	36 %	Mood	2 %

DAYLIGHT

STUDIED DAYLIGHT PARAMETERS	SPACE TYPE CONTEXT		ADDRESSED IMPACTS	
Daylight variations	Healthcare	36 %	Recovery/Health/WB	55 %
Daylight exposure	Office	19 %	Mood & Arousal	46 %
Carry - over effect	School	9 %	Cognition	36 %
Window positioning	Outdoor	9 %	Perception	27 %
Glare	Laboratory	36 %	Welbeing	27 %

VISUAL ATTRIBUTES CONTRIBUTION TO THE ENVIRONMENTAL PSYCHOLOGICAL DETERMINANTS

PREFERENCE
correlates with
KAPLAN'S DETERMINANTS OF ENVIRONMENT:

- **COHERENCE** - EASY TO UNDERSTAND
- **LEGIBILITY** - EASY TO EXPLORE
- **COMPLEXITY** - ELICITS INTEREST
- **MYSTERY** - IS INCENTIVE

COMFORT
correlates with
PROSPECT REFUGE THEORY COMPONENTS

- **FEELING OF SAFETY**
- **OPPORTUNITIES FOR OBSERVATION**

STRESS RELIEF
correlates with
ATTENTION RESTORATION THEORY COMPONENTS

The environment supports stress relief and attention restoration when:

- SUPPORTS **INTENDED ACTIVITIES**
- SUPPORTS **EFFORTLESS ATTENTION**
- PROVIDES **SCOPE AND COHERENCE**
- ALLOWS **TAKING DISTANCE FROM ROUTINES**

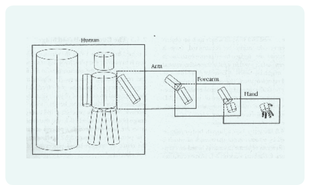
Legend: ○ Studied impacts on psychological and physiological subgroups ▶ Studied impacts on main psychological and physiological categories ● Contributions to space characteristics

From Form Recognition to Form Creation:

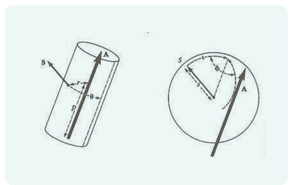
FROM DAVID MARR TO FRANK LLOYD WRIGHT

David Marr's Primitives:

Object-centered axes of primitives

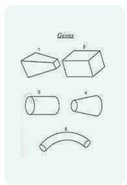


Organization of primitives



Specifying the spatial relationship of primitive axes to each other

From this point on, Marr's primitives serve as an armature for the measured addition of detail. The symmetry of the primitives facilitates measurement. Considerable elaboration will follow to fully articulate a final form.

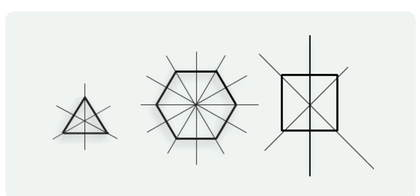


Geons, if they exist, may abet the process

Final result:
An accurately depicted figure

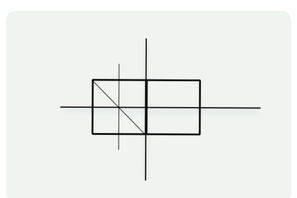
Frank Lloyd Wright's Primitives:

THE PRIMITIVES

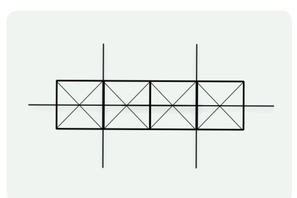


The tileable regular polygons and their axes

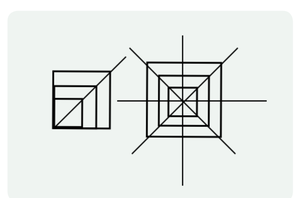
PERMUTATIONS OF THE PRIMITIVES



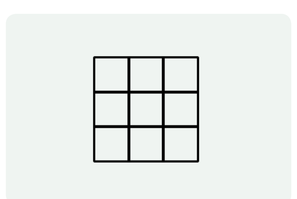
Double-square



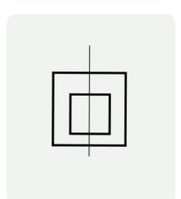
Run of squares



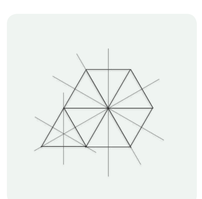
Rescaling



Tiling



Bilateral symmetry



Equilateral triangle and hexagon

The equilateral triangle and hexagon are kin and readily interact, one form generating the other.

In the VC Sundt, a triangular home emerges from a hexagonal grid.

1 **Building on Primitives is the key to David Marr's theory of form recognition and to Frank Lloyd Wrights method of form creation.**

- The critical elements held in common by the Marr and Wright primitives are their simplicity, their symmetry, and their ability to be superimposed at different scales.
- From the largest to the smallest, the primitives remain and retain their integrity in the final form, cycling in a dynamic, time-dependent percept.

  For Marr, "The stability of the representation is greatly enhanced by including both large and small primitive descriptions of the shape and by decoupling local spatial relations from more global ones." (pg. 306, *Vision*)

  For Wright, inclusion in the aesthetic image of all primitives, large and small, promotes stability while generating movement and vitality. For him, the primitives and their permutations remain simple and pleasing but, by cycling, are experienced integrated into a rich fabric.
- **Marr's** primitives are all generalized cones, "armatures" on which the final form will be articulated.
- **Wright's** primitives are found in the plans of the buildings and can be considered cross-sections of generalized cones that rise from the plan to form the building. The plan has considerable power to express the three-dimensional building, thanks to the asymmetry imposed by gravity on our spatial experience. Gravitation constrains how the building rises from the the plan in the vertical dimension; hence the two planar dimensions dominate. "The plan is the beginning and the end…" Wright has written. Wright focuses on the plan, and by limiting himself to the regular polygons, weaves his magic by crystallizing simple and symmetrical but ultimately highly developed forms about the two planar axes and subordinate diagonal axes.

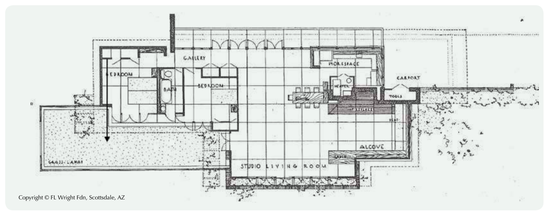
2 **In his determined search for simplicity Wright intuitively went to basic mechanisms of perception; thereby he achieved maximum effect from least effort, reaping complex but thoroughly integrated compositions from the simplest means.**

3 **This gives us the foundations for a Theory of Aesthetics; a theory of simplicity in variety, of maximum effect from minimum effort. As given rigorous treatment in the 1920s by the mathematician George Birkhoff:**

Aesthetic Measure M = Order O/Complexity C

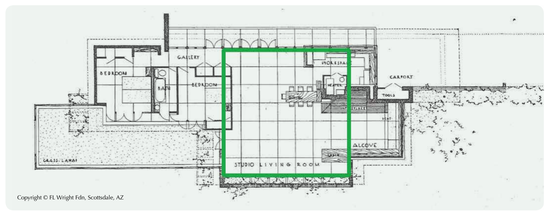
(Note that Complexity is in the denominator: thus, the more Complexity, the less Aesthetic Pleasure. With respect to order, Birkhoff writes that "the object [of aesthetic contemplation] is characterized by a certain harmony, symmetry, or order (O), more or less concealed, which seems necessary to the aesthetic effect.)

Frank Lloyd Wright's Process:



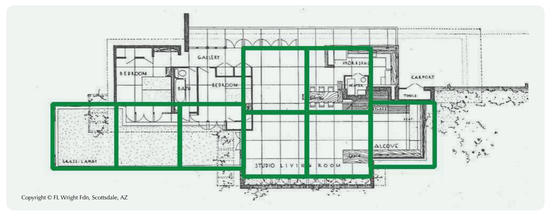
The GOETSCH-WINKLER HOUSE
Built in 1939 in Okemos, Michigan. Like all of his works it is designed on a grid of regular polygons. This house is based on a grid of 4' squares.

"The buildings I have built – large and small – are fabricated upon a unit system…" FLIW



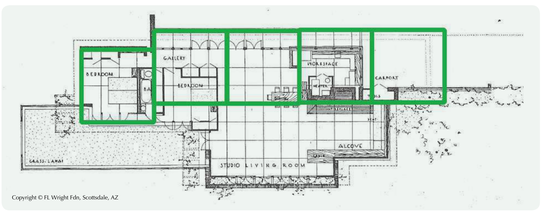
Its underlying theme, the square, is dramatically introduced by one large 7-unit square that extends from one window wall to the other and runs the width of the living room, centering and stabilizing the living area.

"'Think in simples' as my old master used to say, - meaning to reduce the whole to its parts in simplest terms, getting back to first principles." FLIW

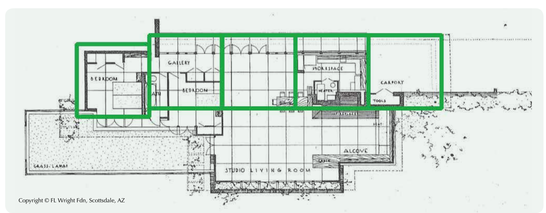


This 7-unit square subdivides into four 3½-unit squares, and these multiply along the lower part of the plan to generate a run of six 3½-unit squares outlining the grass lanai at one end and the outer edges of the alcove roof at the other.

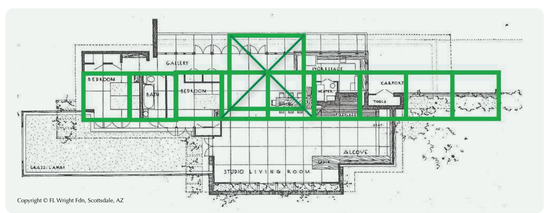
"The differentiation of a single, certain, simple form characterizes the expression of one building." FLIW



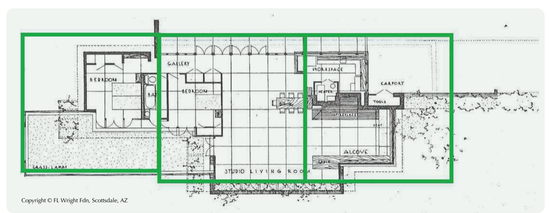
Above this run a series of 4-unit squares fixes the carport roof at one end and terminates at the prominent entry pier at the other. A fifth 4-unit square translated down one unit outlines the master bedroom and its porch.



The upper 5-unit run, aligns with the roof line but not with the interior walls; but if we slide the run ½ unit to the left, we now find that the vertical sides of two squares coincide with the inner bedroom and the kitchen walls, and the fifth square, when slid downward ½ unit, perfectly coincides with the bedroom rooflines and lower wall.



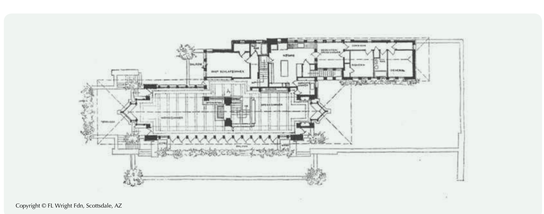
From diagonals of one of the 4-unit squares, two 2½-unit squares are generated that form a double-square. Doubled in turn, to the right it generates a double-square that encompasses the fireplace/tool shed masonry wall; two squares more generated further to the right locate the fascia of the carport roof and the terminus of the extended carport wall. Multiplied to the left, the double-square forms a run that terminates neatly at the master bedroom exterior wall.

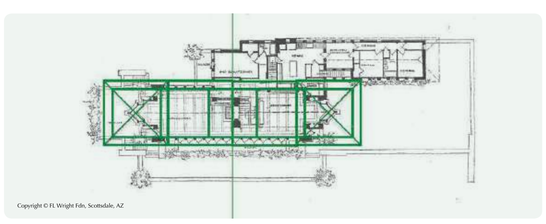


Finally, the whole fits neatly into three squares: a double-square envelopes the interior to the right of the projecting pier, and outlines the entry and carport roofs; a slightly diminished square encompasses the grass lanai.

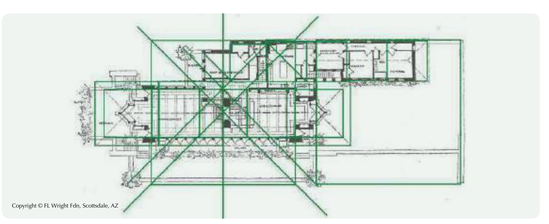
Final result: A work of architecture

The FREDERICK ROBIE HOUSE
One of the greatest of the Prairie Houses, the Robie House of 1906 combines a powerfully thrusting, energy-charged dynamism with perfect balance and rock-solid rootedness. The boldly cantilevered long roof is beautifully poised over the linear porch and its walled terrace and courtyard. But what law determines the reach of the cantilevers thrusting far enough to be dramatic but not so far as to seem foolish? The answer lies in the hidden geometry.





Two nested runs of squares dominate the organization. A run of four squares that fixes the proportions of the boldly cantilevered roof grows with concentric symmetry from a spine of five squares that determine the width of the living and dining rooms.



From the inner faces of the two outer squares in the 5-square run is generated a large square whose right and left ends bisect the heavy piers at the outer corners of the living and dining rooms and whose top and bottom faces encompass the rear bedroom wing and the front garden planters, creating a stable foundation about which the main living spaces symmetrically and dramatically unfold. Diagonals extending from the front garden planters lock the rear wing to the rest of the house. One diagonal fixes the rear balcony planter, and from the other is generated a square that in turn generates a string of squares outlining the bedroom wing. The right planter also touches the left lower corner of a large square that defines the service yard, completing the composition.

ANFA CONFERENCE 2018

STRENGTHENING THE PHYSICAL AND MENTAL HEALTH OF CHILDREN MEANS OF ENVIRONMENTAL DESIGN: THE METHOD OF FORMING A THERAPEUTIC LANDSCAPE

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Introduction

Lack of physical activity and contacts with nature negatively affect the health of the younger generation. This raises serious concerns among pediatricians and sharpens the issue of creating conditions for strengthening and preserving the health of the child population.

Since the soviet period in Russia and Armenia the network of institutions of restorative and preventive medicine, such as sanatoriums and dispensaries, struggles with this problem. Recently there appeared tendency of redevelopment of these facilities. The factors affecting children's health, in particular, the role of architecture and design of the environment [7, 8] especially landscaping [1, 5], in strengthening the health of children are considered.

This work is based on the analysis of examples of international experience in development of therapeutic gardens in children's hospitals, using various types of play-ground equipment, their impact on children health as well as the impact of contact to nature [14, 15, 17, 18].

The hypothesis of the study is the assumption of the importance of educating the child for the desire to interact with nature at an early age, because "the ecological education in childhood creates the basis for his treatment with landscape therapy in sickness and in older age <…>. This hypothesis requires significant studies in different regions to identify the nature of this dependence" [24].

Based on the research, a method for developing therapeutic landscape projects for children from 2 to 7 years is proposed, taking into account the optimization of the use of play-ground equipment, planting and hard-scape design to stimulate the perception of the environment and the activity of children, which can be applied both in healthcare institutions, residential areas and kindergartens, as well as children's hospitals, if adopted to their profile.

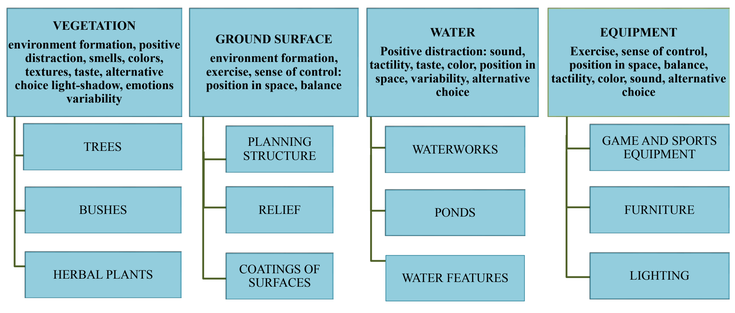
Approbation of the methodology is carried out on model projects which are planned to increase the therapeutic potential of landscapes in children's health centers in St. Petersburg and Yerevan.

In St. Petersburg, the work is based in the DESIS laboratory of St. Petersburg University, in Yerevan – in the Department of Hygiene and Ecology of Yerevan State Medical University.

Methods

METHODS OF INTERACTION OF A CHILD WITH LANDSCAPE

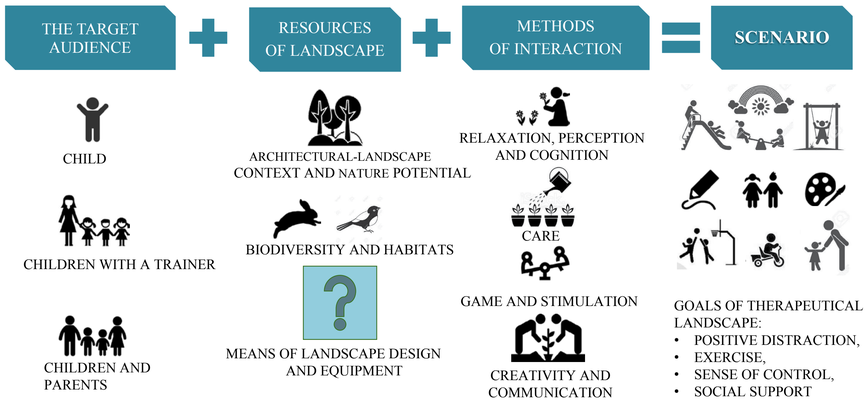
DETECTING THE RESULTS OF INTERACTION WITH LANDSCAPE COMPONENTS



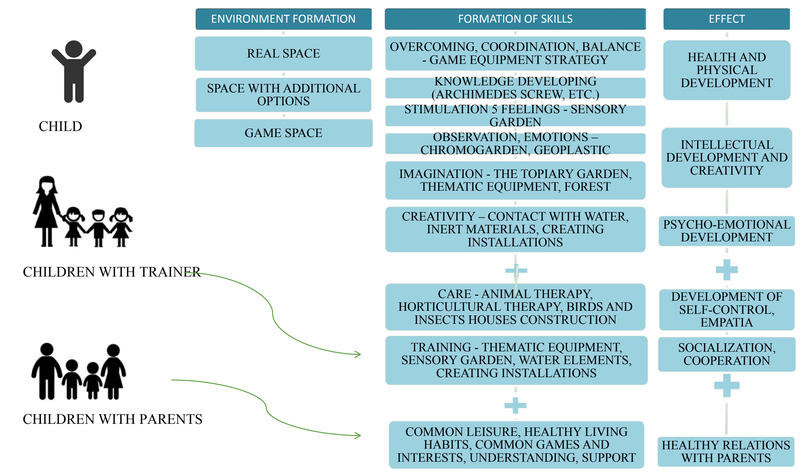
Results

THE METHOD OF CREATING A THERAPEUTIC LANDSCAPE FOR CHILDREN

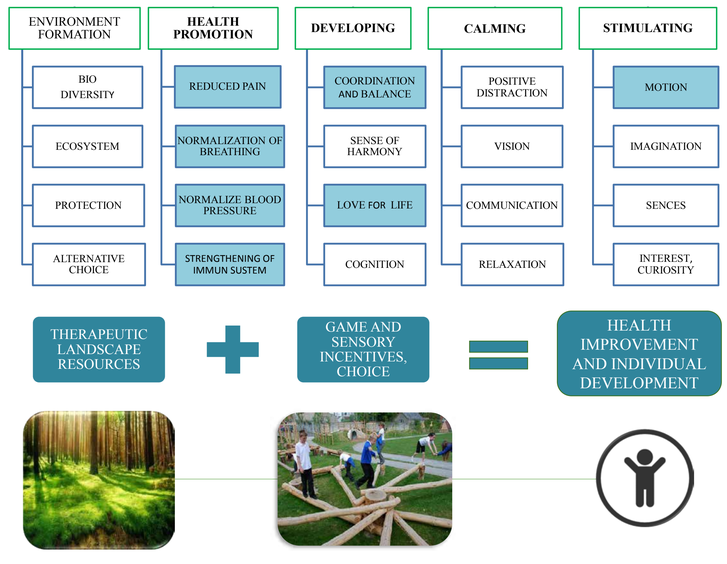
- SCHEME FOR FORMING THE SCENARIO OF INTERACTION OF CHILDREN WITH LANDSCAPE



CONCEPT OF A HEALTH GARDEN FOR CHILDREN



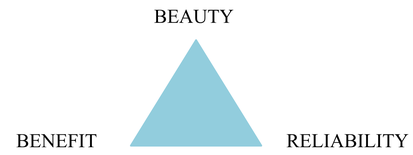
ASPECTS OF THERAPEUTIC EFFECTS OF LANDSCAPE ON CHILDREN



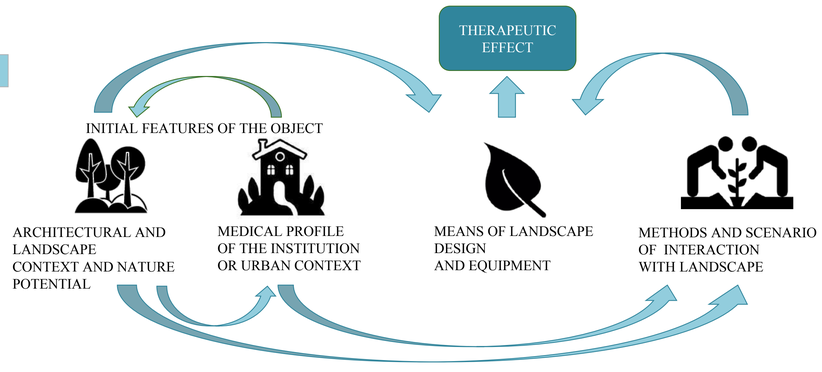
Discussion

Vitruvius triad for therapeutic landscapes: design for positive impact on health as an alternative for disconnection of children from nature in urban environment.

BENEFITS	RELIABILITY	BEAUTY
1. Reduction of air pollution.	1. Biodiversity.	1. The predominance of gardening over hard coverings.
2. Decrease in air and surface temperatures.	2. Ecological sustainability of the landscape concept.	2. Positive contrast with the environment, a sense of relaxation: a sigh of relief, a breath of fresh air, etc.
3. Increase of humidity.	3. Quality planting material.	3. Cultural "recognizability" of the landscape.
4. Noise reduction.	4. Quality of soils, materials of coatings and structures, water disposal.	4. Absence of objects causing a feeling of fear and anxiety.
5. Saturation of air with oxygen.	5. Compliance with construction technology.	5. Creation of spaces with different emotional impact, depending on the dominant plant and geomorphological forms.
6. Allocation of useful substances (phytoncids, etc.)	6. Compliance with the timing and technology of planting, care work.	6. The prevalence of calm colors, the creation of expressive accents, structuring space
7. Biopositivity, restoration of the ecology of the habitat.	7. Security.	7. Sensory interactivity.
8. Reduction of stress, depression, chronic diseases	8. Availability for disabled.	
9. Reducing crime, aggressiveness of children.	9. Availability in terms of distance, residence mode, visual contact from the interiors.	
10. Improving health and mood		
11. Return of sense of control and freedom of choice		
12. Increased physical activity		
13. Improving the quality of life		
14. Increased life expectancy.		



Conclusions



THE CHOICE OF OPTIMAL MEANS OF FORMATION OF THERAPEUTICAL LANDSCAPE

MUST EXIT FROM:

1. AVAILABILITY OF THERAPEUTIC RESOURCES OF NATURAL LANDSCAPE,
2. NEEDS IN DIFFERENT TYPES OF STIMULUS FOR THE EXPECTED IMPACT OF EXPOSURE,
3. SCENARIO AND METHODS OF INTERACTION WITH LANDSCAPE IN ACCORDANCE WITH AGE, PECULIARITIES OF HEALTH, INDIVIDUAL NEEDS (PHYSICAL AND PSYCHOEMOCONAL) OF THE PATIENT

THE SELECTION OF THERAPEUTIC LANDSCAPE DESIGN IS DETERMINED BY THE PLANNING OF THE COMPLEX IMPACT OF LANDSCAPE ON THE PATIENT WITH THE OBSERVATION OF METHODS AND THE SCENARIO OF INTERACTION OF THE PATIENT WITH LANDSCAPE AND INITIAL CHARACTERISTICS OF THE OBJECT.

References

1. *Chun-Yen Chang, Ping-Kun Chen, William E. Hammitt, Machnik L. Psychophysiological Responses and Restorative Values of Wilderness Environments //USDA Forest service Proceedings RMPS. - 2007 . PP. 479-484. http//:www.fs.fed.us/*
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Blurring the Self/Space Boundary to Increase Mindfulness:

Perspectives from Japanese Architectural Philosophy, Neuroscience, and Psychology

Yale

Yoko Kawai, PhD,[1] Kathleen O'Connor Duffany, PhD,[2] Kathleen A Garrison, PhD[3]

[1] Yale School of Architecture, [2] Yale School of Public Health, [3] Yale School of Medicine

1. INTRODUCTION

Mindfulness:
Paying attention in the present moment, on purpose and non-judgementally.

Objective:
To explore how space might be designed to increase mindfulness, by integrating Japanese philosophies of architecture and mindfulness.

2. HOW WE PERCEIVE THE SPACE WHEN MINDFUL

When we are mindful, boundary between self and space/surroundings is blurred.

IN ZEN BUDDHISM

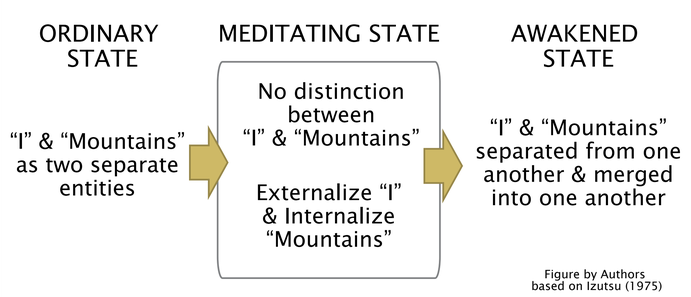


Figure by Authors based on Izutsu (1975)

IN JAPANESE PHILOSOPHY

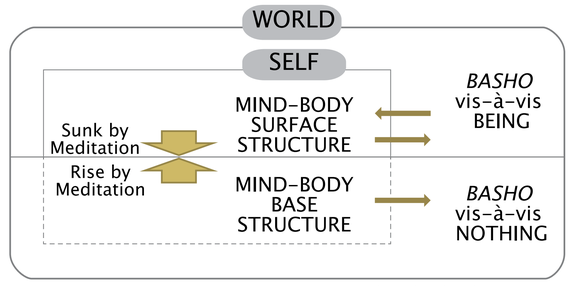
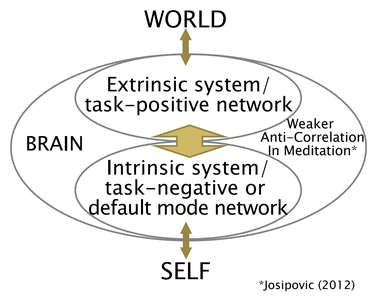


Figure by Authors based on Yuasa (1987)

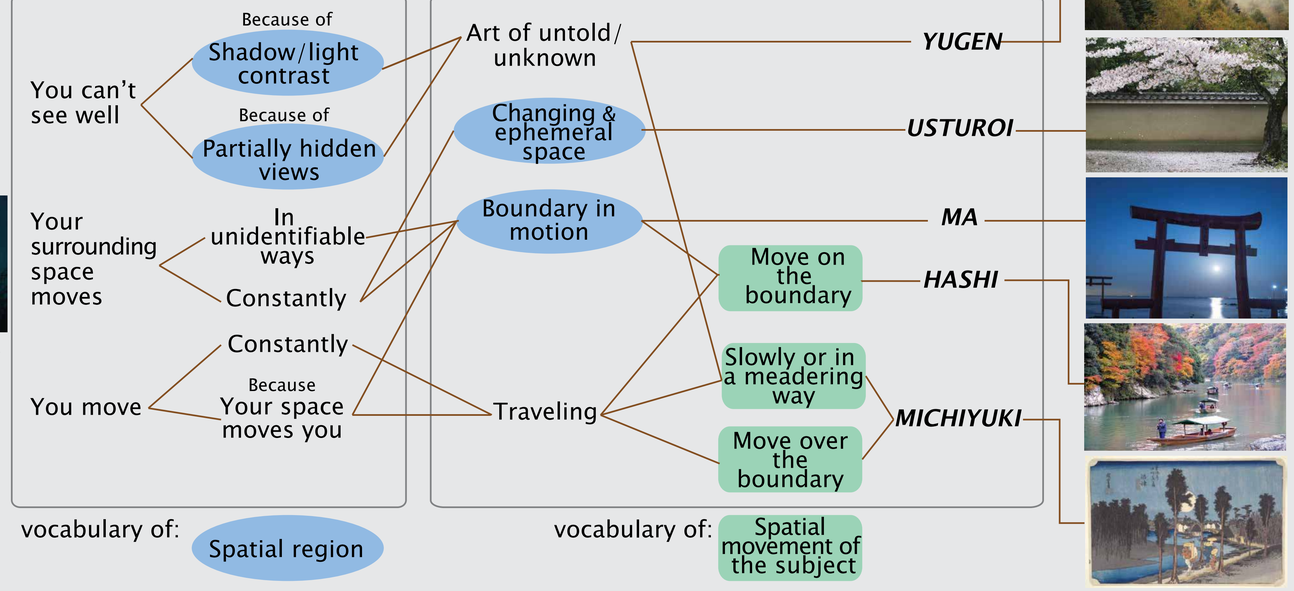
IN NEUROSCIENCE



*Josipovic (2012)

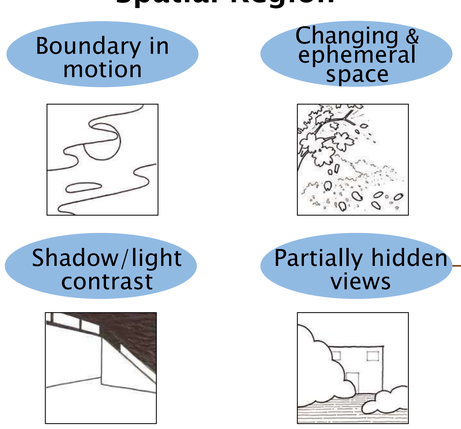
3. HOW JAPANESE SPATIAL CONCEPTS MAKE THE SELF/SPACE BOUNDARY BLUR

Self/space boundary blurred under the water

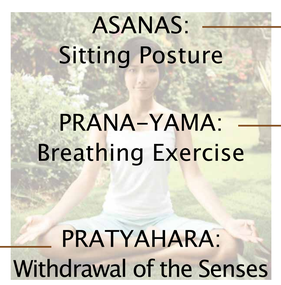


References:
Kaplan (1981)
Isozaki (2006)
Inoue (1985)
Nitscheke (1993)
Haga (1995)
Hara (1987)
Katagiri (2007)
Takeuchi (2011)

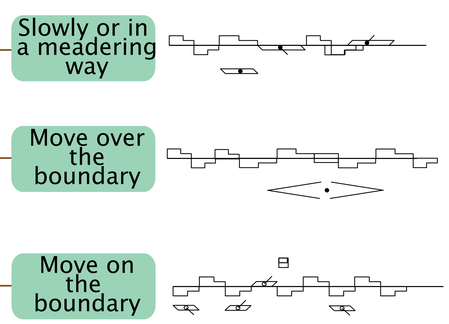
Typical vocabulary of Spatial Region



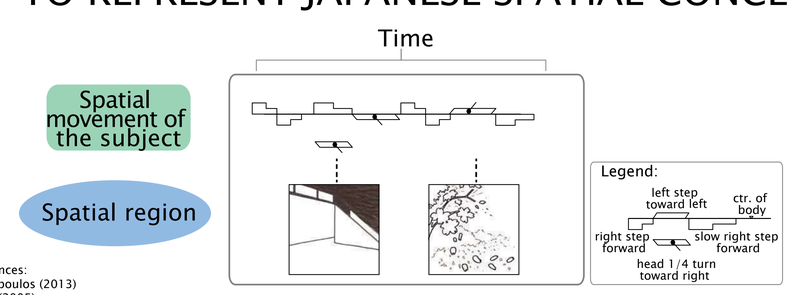
Stages of Yogic Meditation



Typical vocabulary of Spatial Movement of the Subject



4. IMPLEMENT "SPACE-TRAVELER'S" NOTATION SYSTEM TO REPRESENT JAPANESE SPATIAL CONCEPTS



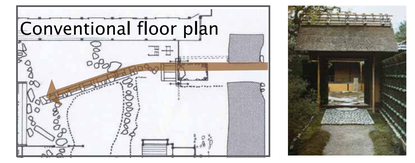
References:
Yannopoulos (2013)
Guest (2005)

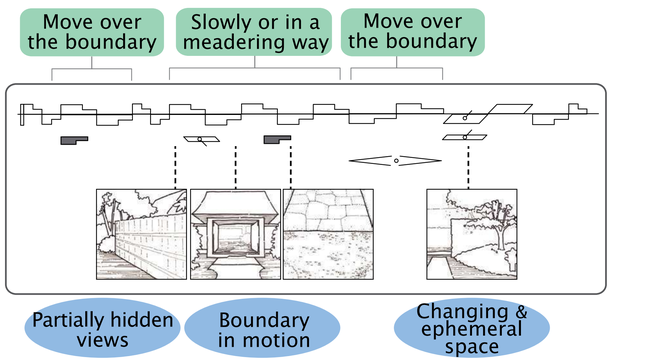
Applying DirectorNotation system from film & Labanotation from dance

The new "Space-Traveler's" notation system represents ***time & space*** from a ***first-person perspective***.

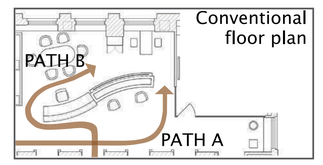
5. REPRESENT/DESIGN/TEST A SPACE USING "SPACE-TRAVELER'S" NOTATION SYSTEM

Represent Traditional Space
-Katsura Imperial Villa



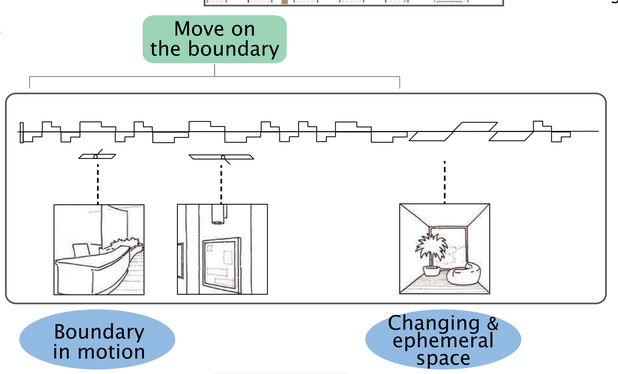


Design & Test an Office Space

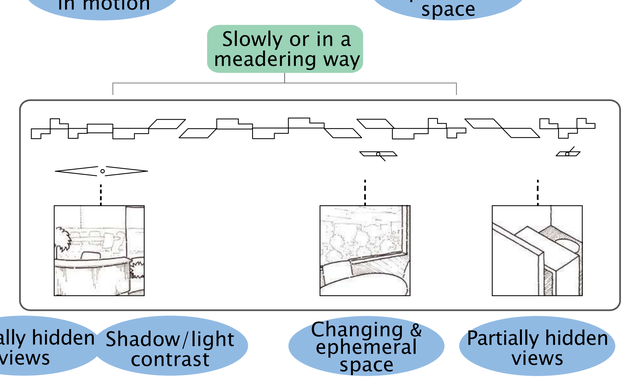


Future study by real-time monitoring of neural signal

PATH A



PATH B



6. CONCLUSION

This new Space-Traveler's notation system, integrating vocabularies from Japanese spatial concepts, can be used to represent, research, and design spaces to increase mindfulness.

Ambiance in Spiritual Spaces

Examination of themes of light and nature in student design proposals

Judy Theodorson, M.Arch, Associate Professor, Washington State University

This research is concerned with ambiance in spiritual spaces. For the purpose of this abstract, ambiance is described as spatial and sensory qualities that shape a phenomenological experience. In the broadest of terms, spiritual spaces embody the metaphysical to deliver a higher order experience. Such experiences vary widely, ranging from a sense of connection, to a quiet moment of contemplation, to enlightenment. From a neurological perspective, the goal could be described as reseting one's mental and/or emotional state.

The method for exploring ambiance in spiritual spaces is to analyze conceptual design proposals produced for a 2018 IDEC Interior Design Student Competition titled Fundamental Atmospheres: Designing for Spatial and Spiritual Experiences.* The brief was purposefully broad, asking student designers to provide for the empowerment of users to grow intellectually, spiritually, mentally, or metaphysically. The program could be a religious practice (traditional or emerging), a secular space of reflection or mindfulness, and/or places for commemoration. The students were to define the specific use and to develop an atmospheric intervention. Furthermore, they were encourage to engage experiential and primary research methods and to use light as a material of design.

The top 25 projects (out of 155) were examined to uncover the presence and potency of two architectural themes that link ambiance to known neurological outcomes: light and nature. The human relationship to light is partially biological: humans are drawn to light and fear the dark. Moreover, daylight is critical in regulating our circadian system and therefore our well-being, performance, and mood (Edwards & Torcellini, 2002). More significant to spiritual spaces is the aesthetic and transformative powers of light, described by Plummer (1992) as "almost magical" with the capacity to endow "material form with the wholly immaterial force of the human spirit" (p.19). Over history of architecture, light has played a critical role in spiritual spaces, a transforming ambiance that serves as a conduit to divinity or a shift in mood / consciousness. The nature theme includes a wide array of sensory inputs including air movement, thermal variation, natural light, water and plant features, and natural materials. Exposure to nature is widely accepted as beneficial to human neuro-function, a calming influence in a modern world of cognitive overload. Theoretical foundations include the "biophilia hypothesis" which establishes that humans have the urge to affiliate with other forms of life (Wilson, 1984); furthermore, Wilson describes nature as holding the" key to our aesthetic, intellectual, cognitive and even spiritual satisfaction." Kaplan's (1995) Attention Restoration Theory (ART) suggests that certain nature experiences are restorative in that they support concentration, leading to recovery from mental fatigue.

The value of examining student proposals is to understand the processes and inputs students use in developing the ambiance of spiritual spaces. Ultimately, the data extracted from the student proposals confirms the existence and potency of light and nature themes; they were prominent in more than 75% of the projects. Did the students arrive at this direction experience, intuition, and/or evidence? Did they uncover the neurological connection? Most of the students did engage in traditional research such as precedent, evidence-based design, and theoretical foundations. Surprisingly, a minority of the students engaged in meaningful experiential research despite the fact the most of the projects aimed to achieve an experiential space. This suggests a disconnect between traditional and phenomenological methodology. On the other hand, many of the renderings indicate rich atmospheres of light and nature and materiality and nearly all of the top selections show humans in some sort of contemplative pose; this indicates the students understood how to produce an abstract representation of ambiance.

While several of the projects had a specific program (teahouse, community kitchen, spa, experiential art gallery), most aimed for a non-defined meditative space with multiple use options. What differentiates a "meditative space" from a multi-use space is a sense of ambiance. In these projects, the ambiances was produced by integrating aspects of light, nature, and / or water, and a spare palette of natural materials. This suggests a future direction for interiors, one that finds aesthetic and neurological value in the light-nature ambiances for a variety of interior programs.

Edwards, L. & Torcellini, P. (2002). A literature review of the effects of natural light on building occupants. Golden, CO: National Renewable Energy Laboratory.

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology* 15(3), 169-182.

Plummer, H. (1992). *Light and the soul of architecture*. Oz: Vol. 14. h ps://doi.org/10.4148/2378-5853.1232

Wilson, E.O. (1984). *Biophilia*. Cambridge, MA: Harvard University Press.

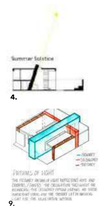
*the author was the co-author of the competition

light

Many spaces are designed to collect and distribute natural light; ideas include filling interiors with light and inviting human use. Design investigations range from massing models to diagrams to digital solar studies. Design precedents include buildings such as the Pantheon.

collecting light

4.Kirsten L. Montalbano, Virginia Tech: *Yugen Student Meditation Center*



Inspired by clouds, forests, and light reflecting off water, several projects sought to create ethereal ambiances by filtering or modifying light. This was also a topic found in readings on spiritual light. Physical modeling with materials and light are the primary methods for design exploration.

filtered light

2. Sarah Morgan Nix, Montana State University: Inhale Exhale Spatial Textile Design

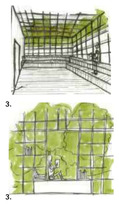
Several projects emphasized the relationship of light and dark and our attraction to light movement and shadow patterns. Inspirations include dappled light in nature, dance, and poetry in addition to readings by light experts and visits to precedents such as the Holocaust Museum. Methods for exploration include physical models and digital representation.

patterns of light + dark

10.Dana Calinisan, British Columbia Institute of Technology: YUME

nature

A number of projects intentionally blurred the boundaries between interior and exterior by treating vegetation as a primary interior spatial material. Other projects seamlessly integrated courtyard and interior.



interior landscapes

7.Alexandrea Sosalla, University of Minnesota: Reflectera

Biophilia theory and patterns were often cited as support for bringing people and nature into contact. Experiential research included journaling and photography in natural setting where students discovered beauty in patterns of nature and pleasure from sensory stimulation.

biophilia

1. Alyssa Garvey, Endicott College: Field of Flowers

Empirical research studies formed the foundations for the thesis that nature = health and well-being. Furthermore, experiential research from sitting in nature produced feelings of calm and seemed to clarify the mind.

well-being

3. Kelsey Muir, Virginia Tech: House of Verse: Poetry Library for Exploration of Ideas and Mindfulness

design credits
1. Alyssa Garvey, Endicott College: Field of Flowers
2. Sarah Morgan Nix, Montana State University: Inhale Exhale Spatial Textile Design
3. Kelsey Muir, Virginia Tech: House of Verse: Poetry Library for Exploration of Ideas and Mindfulness
4. Kirsten L. Montalbano, Virginia Tech: Yugen Student Meditation Center
5. Yasaman Saeidi RCC Institute of Technology: The Chamber of Light
6. Tori Palynchuk, British Columbia Institute of Technology: Perpetua
7. Alexandrea Sosalla, University of Minnesota: Reflectera
8. Sasha Weleber, Fashion Institute of Technology: The Light Observatory
9. Chloe Cudney, Kansas State University: Sacredness Among Scarcity
10. Dana Calinisan, British Columbia Institute of Technology: YUME

Exploring garden design composition and its effect on psychophysiological and behavioral responses

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Graduate School of Systems Life Sciences, Kyushu University, Fukuoka, Japan
*Contact: reikateo@gmail.com

KYUSHU UNIVERSITY

In this work, we compare two different garden designs to explore which characteristics play an active role in enhancing our health.

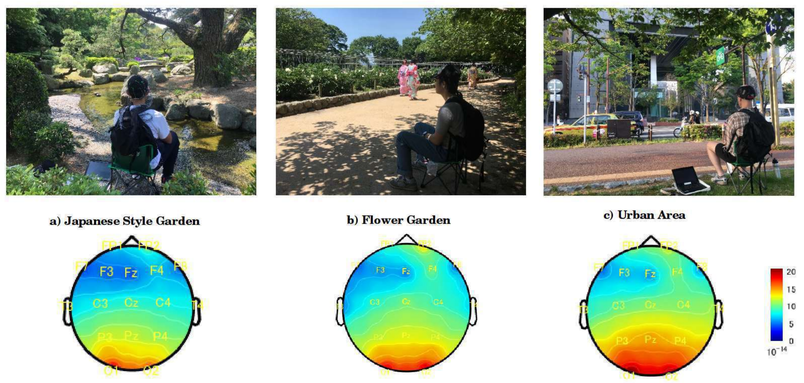
- Psycho-physiological responses of participants showed on Japanese garden *a* greater calming responses than Flower garden and Urban environment.
- The results aim to contribute to the improvement in the design of gardens that can be integrated into urban environments like hospitals and workplaces among others to enhance psycho-physiological wellbeing.

Introduction

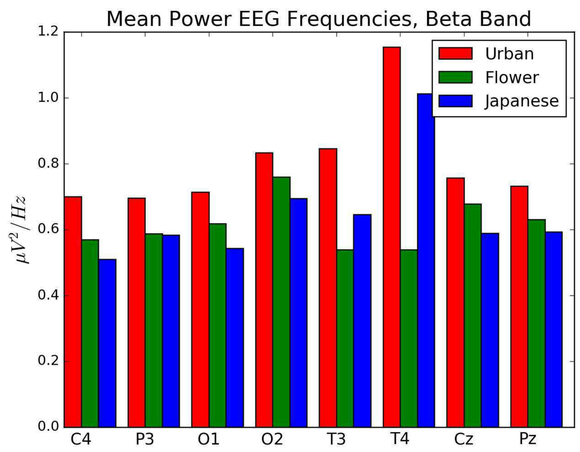
Our daily experiences produced by the physical environment have an active role in our health and wellbeing. Experimental researchers have been studying the *benefits of exposure to natural* environments, finding that *natural surroundings cause more calming responses than urban surroundings*; such as a *reduction in physiological stress*, improved r*ecovery from mental fatigue*, and the *enhancement of positive emotions*.

Experimental Method

- The experiment was conducted in Fukuoka city, Japan, in May. The average temperature was *23* celcius.
- The studies recorded Physiological responses of *(EEG) 17* electrodes and *(HVR)* of participants *(n=15)*. Average age *27*.
- Participants viewed three different spaces for 11 minutes; ***a)*** *Japanese style garden*, ***b)*** *Flower garden* and **c)** U*rban area*.
- After viewed completion, the experiment participants performed a *reaction- time (RT) task* to determine the *behavioral effects* and *self-report questionnaires (PANAS)* and *(STAI)* were conducted to investigate the *emotional state* of participants.

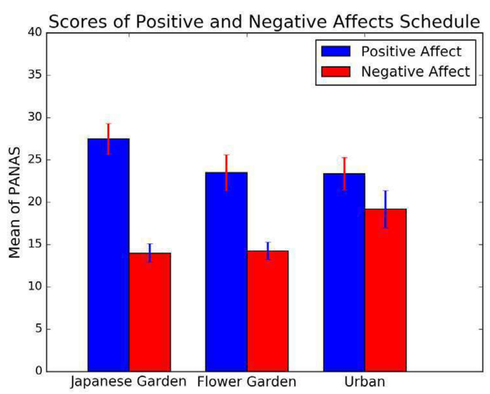


EEG Topology in beta band. Average of *14* participants in each experimental condition. T-test showed a significant difference among the three environments *($p < 0.01$).*

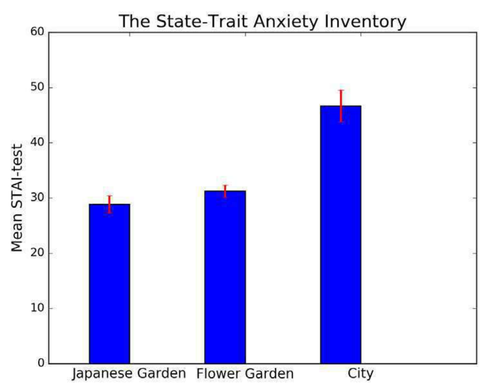


Mean power EEG frequencies for beta band while viewing to three environments. Significant differences where found among the electrodes ($p<0.05$). Urban environment and Flower garden showed greater activity on frontal and occipital area in comparison with Japanese garden.

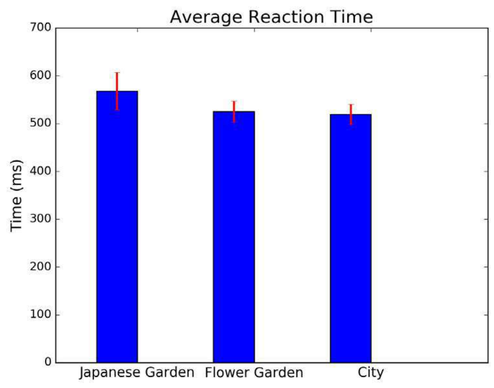
Results



Comparison of Positive and Negative Affect scores between three environments. *N=15*, mean and standard error. Positive Affect showed s*ignificant differences* between Japanese garden and Flower garden (p<*0,01).* Negative Affect showed. *significant differences* on Japanese garden and Flower garden from Urban condition (p<*0.001).*



Measure of trait and state anxiety between three environments. *N=15*, mean and standard error. Japanese garden and Flower garden found *significant differences* from Urban condition (p<*0.000)1.*



Behavioral results. Mean reaction time for the trials, after viewing three different environments, *N=15*.
No statistical differences were found between the conditions.

Conclusions

- Physiological measures of (EEG) showed lower beta wave arousal in participants that where exposure to Japanese garden settings. These results are in line with (PANAS) and (STAI) self-reports that showed greater calming responses and positive emotions in Japanese gardens settings.
- These results proved that a well-designed garden can help to reduce stress in our everyday life and contribute to emotional restoration.
- On future research (HRV) and (EEG) alpha band will be analyzed.

PERCEIVED INTEREST AND HEART RATE RESPONSE TO FAÇADE AND DAYLIGHT PATTERNS IN VIRTUAL REALITY

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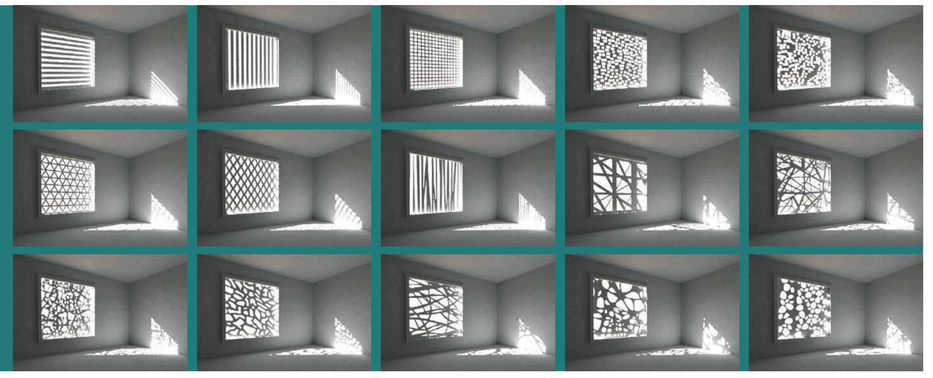
[2] Behavioral Genetics Laboratory (LGC), Ecole polytechnique fédérale de Lausanne (EPFL), Switzerland
[3] Cognitive and Affective Regulation Laboratory (CARLA), Institute of Psychology, University of Lausanne (UNIL), Switzerland
*presenting author

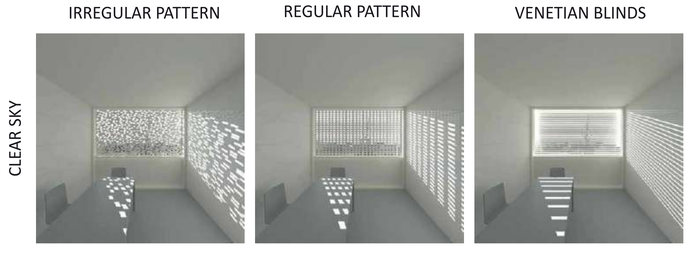
This study is part of a wider investigation of the impact of façade characteristics on human perception and physiological responses. In this contribution, we present an experimental study conducted in Virtual Reality (VR), where participants were exposed to scenes of an interior space with different façade patterns, and their subjective responses and heart rate were recorded.

Three variations of façade patterns were investigated, with, as shared attributes, the façade material and the perforation ratio (open to total façade surface), and as varied attributes, the pattern regularity and the geometry of aperture. The variations were shown in a VR headset, which has been shown to accurately convey the perception of real spaces lit with daylight. The scenes were presented in random order to 72 participants, however 16 were excluded from the analysis after visual inspection of the physiological data. The participants evaluated how pleasant, interesting, and exciting they perceived the space in the three conditions, while their heart rate was recorded with the Empatica 4 wristband.

The results show a statistically significant effect of façade and its corresponding daylight pattern on the perceived interest, as well as on the mean heart rate change. Specifically, during exposure to the irregular pattern, participants rated the space as more interesting and their mean heart rate was lower, resulting to a greater mean heart rate change compared to the baseline. Our findings suggest that the effect of architectural façade elements on human experience is quantifiable and highlight the need for further studies on the perceptual and physiological effects of built environments.



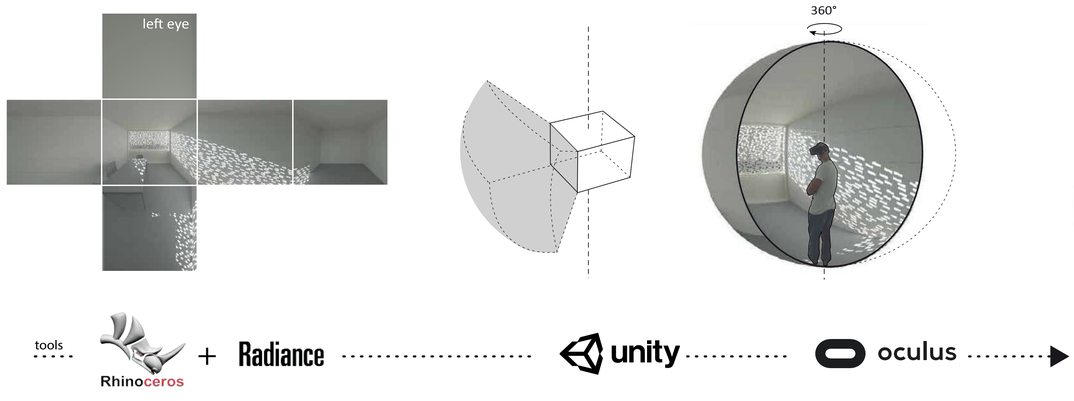
1 EXPERIMENTAL DESIGN



Façade variations used in the study, with an equal perforation ratio (25%).

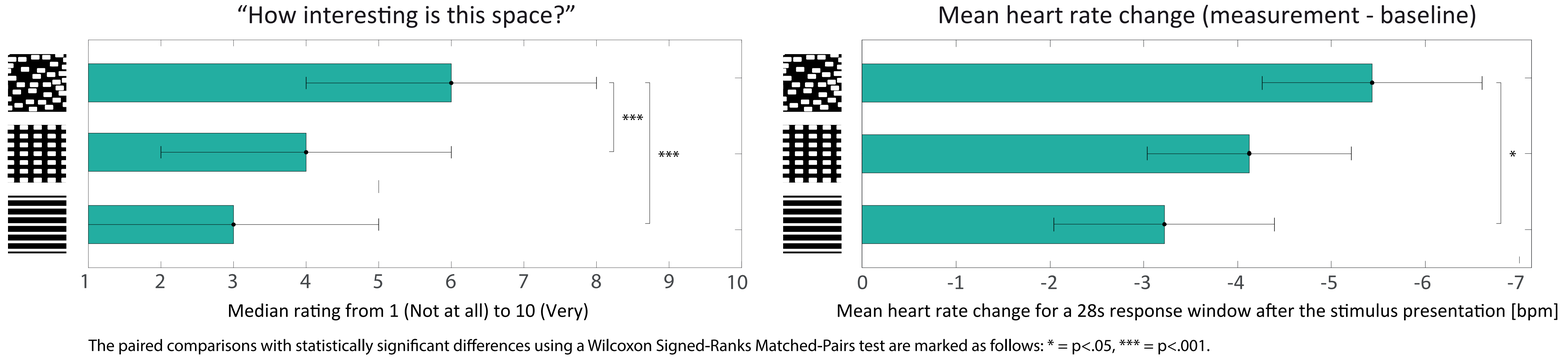
- three façade patterns with same perforation ratio
- within-subject experimental design
- experimental study in VR with 72 participants
  - subjective responses *perceived interest*
  - physiological responses *heart rate*

2 WORKFLOW AND EXPERIMENTAL PROCEDURE



3 RESULTS

significant effect of façade and daylight pattern on:
- perceived interest
- heart rate change



The paired comparisons with statistically significant differences using a Wilcoxon Signed-Ranks Matched-Pairs test are marked as follows: * = p<.05, *** = p<.001.

KYNTHIA CHAMILOTHORI - ✉ kynthia.chamilothori@epfl.ch

Kynthia joined LIPID as a doctoral candidate in February 2015. She graduated with honors from the Technical University of Crete with a Master's degree (Dipl-Ing) in Architectural Engineering in 2014, receiving the Limmat Stiftung Excellence Award for her academic performance. Her research diploma project, "Memorigami", a prototype temperature-responsive shading system that integrates smart materials, received an innovation development grant from the 2013 University Student Entrepreneurship Project (UNISTEP).

Her doctoral research focuses on how façade patterns and daylight variability shape the way we perceive architectural spaces. Through experiments in virtual and real environments, she aims to broaden our understanding of the complex effects of daylight composition and variation on the subjective experience.

VELUX STIFTUNG
ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

THERMAL EXPERIENCE
AND THE BENEFITS OF VARIATION ON COMFORT

HYPOTHESIS

Intentional sequencing and varying of thermal conditions over time or over place can be beneficial to perception of comfort and cognitive performance

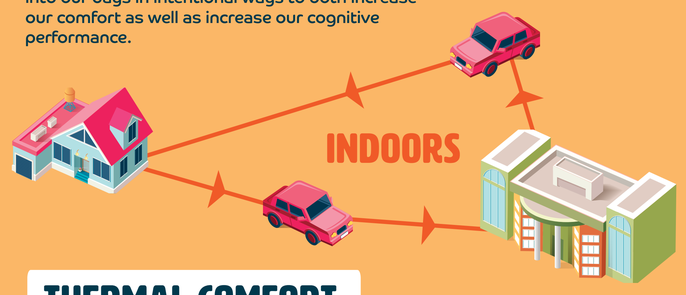
THEORY

CONTEXT

We spend **90% of our time indoors**[1] in conditioned environments. These environments are designed to be static and use significant energy to keep it that way.

However, studies show that **people are frequently unhappy with their thermal conditions**[2]. Studies also show that our bodies are designed for dynamic environments and that we respond positively to external stimuli[3]. Without external stimuli during our days our bodies whither and our minds become less sharp.

We need to **reintroduce environmental variation** into our days in intentional ways to both increase our comfort as well as increase our cognitive performance.



THERMAL COMFORT

There are several scientific and industry developed models for understanding human thermal comfort, defined as **"the condition of the mind that expresses satisfaction with the thermal environment"** (ANSI/ASHRAE). The industry standard for practice is ASHRAE 55 (Adaptive Comfort Model), which uses the following variables to assess thermal comfort:

AIR TEMPERATURE
Describes the temperature (hot/cold) of the air molecules surrounding the body

RADIANT TEMPERATURE
Describes the thermal radiation that emits from a warm object to the body

AIR VELOCITY
Describes the speed of air molecules moving past the body (i.e. affects perspiration levels)

RELATIVE HUMIDITY
Describes the ratio of partial pressure of water vapor to the equilibrium vapor pressure of water at a given temperature (i.e. affects perspiration levels)

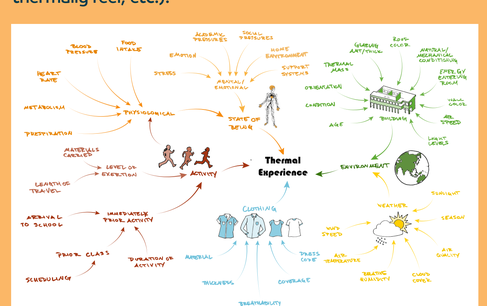
CLOTHING INSULATION
Describes the insulation value, or reduction in sensible heat transfer, of a person's clothes

METABOLIC RATE
Describes the rate of energy expenditure over time for a body in motion (e.g. walking, running, sitting)

PHYSICAL BODY CHARACTERISTICS
While not described directly as a variable in the model, the model itself is based on assumptions about the physical body, which may vary from person to person.

THERMAL EXPERIENCE

At MKThink we are utilizing what we call a "thermal experience" model that includes traditional factors such as those from the Adaptive Thermal Comfort model, which typically relies on thermal perception and impression, as well as factors from psychology such as **expectations** (how what I expect determines what I perceive) and **multi-perception influences** (how what I hear affects what I thermally feel, etc.).



255 SCHOOLS
168,095 STUDENTS
10,265 CLASSROOMS

49 WEATHER STATIONS
700+ INDOOR SENSORS

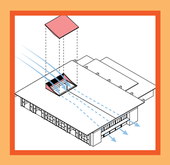
PRACTICE

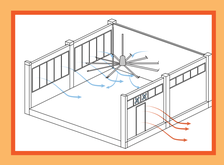
METHOD

Applied field study through applications of differing **Heat Abatement solutions** (see selected examples below) in 255 schools in the Hawaiian islands. "Interventions" will promote natural thermal sensation variation while aiming to avoid traditional solutions such as HVAC systems that create steady-state, "conditioned", environments at a high energy cost per unit of Thermal Experience (Te) delivered.

As of June 2018, 49 schools that cover different (1) Climate Zones, (2) Building Architectural Types, (3) Building Orientations, and (4) Building Materials have had **weather stations** installed to monitor local microclimates, and 700+ classrooms have had **environmental condition sensors** installed to establish in-room environmental condition baselines as well as track changes in environment after interventions.

Additionally, initial **feedback surveys** have been used to gauge initial user impressions of comfort and cognitive performance.





RESULTS

Official results are still *pending* at this time as interventions are being implemented. Data to be collected includes: deg F from peak reduced, % time increase in Adaptive Thermal Comfort zone, user reported comfort/performance gains/losses, and reduction in absenteeism / headaches / sickness / complaints.

Unofficial, anecdotal results suggest positive acceptance of interventions and self-assessed increases in mental performance. However, these results may be skewed by several factors including the positive association with new things.

> "My students always tell me it just feels better, they just feel calm and relaxed. They will come in and eat lunch here and they will be really at ease."

> "I can be a better teacher because I can think clearer."

> "It's worth it because students come to a nicer environment. It impacts the way they think, the way they feel, and ability to be well physically and emotionally."

FURTHER RESEARCH

The current study(ies) is ongoing and will continue over the next two to five years gathering longitudinal data on current interventions as well as introducing new interventions, methods of data collection, and results data. Anticipated next steps may be:

New Interventions
- Thermal Priority Zones (TPZs) where Te (temperature specifically) is set to "prime" users for the next zone
- Weather-Linked Te variation in non-outside rooms
- Time-based Te variation in rooms (possibly **including other stimuli such as olfactory variation**)

New Methods of Data Collection
- Cognitive Performance tests such as the Strategic Management Software tool to assess decision-making

New Data / Metrics
- Student test scores tracked across instantaneous Te and **daily Te variation and sequencing**
- Complete student/teacher survey feedback on Te / Tc impressions
- Te data correlated with non-thermal external stimuli data such as % daylighting, noise level, etc.

REFERENCES
1 " The National Human Activity Pattern Survey (NHAPS): A Resource for Assessing Exposure to Environmental Pollutants"; 2001.
2 International Facility Management Association (IFMA) Survey; 2009.
3 Beneficial Effects of Multisensory and cognitive stimulation in Institutionalized Elderly, 2015. & Influence of Fragrances on Human Psychophysiological Activity, 2016.

MKTHINK

HNEI
Hawai'i Natural Energy Institute
School of Ocean and Earth Science and Technology
University of Hawai'i at Mānoa

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Contributed Posters #4
Friday, September 21st | 5:00 – 5:45 PM

Priscilla Bencke, Bencke Arquitetura e Construções / Brazil
Creation of Neuro-Architecture Study Guide, Facing the Architect, with International Application

Robin R. Randall, Legat Architects / Chicago, Illinois
How Buildings Teach Kindness; Social Emotional Learning Across Generations in Neuroscience and Architecture

Ben Regnier, Gensler / San Diego, California
The Student Experience: The Future of the Academic Library

Raechel French, DLR Group / Austin, Texas
Shifting Teacher Practice in an Innovative Learning Environment

Jonathan Essary, HKS Research / Dallas, Texas
Sensory Wellbeing for Adolescents with Developmental Disorders

Ana Mirea, Ion Mincu University of Architecture and Urbanism / Romania
Childhood Memories and Their Influences for the Architect's Cognition

Mahmoud Ragai Turk & Ahmad Amr Kamal, Future University / Egypt
A School designed to Improve Student's Brain Activity Using Integrated Neuro-Architectural Design Aspects (QEEG-VR)

J. Susan Campbell Marano / Spokane, Washington
Nature is Restorative: A model for a therapeutic, collaborative learning environment for teenagers that incorporates biophilia and neuroscience research to encourage learning and well- being

CREATION OF NEURO-ARCHITECTURE STUDY GUIDE, FACING THE ARCHITECTS, WITH INTERNATIONAL APPLICATION

BENCKE, PRISCILLA
MOURA, SANDRA MARLISE CESCON
DE PLECH, REBECA CALHEIROS DE
NOVAIS ROSA, YASMINE

INTRODUCTION

First voluntary movement of architecture professionals, started in 2008 in Brazil, to the development of a study guide about Neuro-architecture, which is divided in two parts: Theoretical, through a group of studies and Practical, through social actions in public spaces.

ABSTRACT

1. GOALS OF THE GROUP OF STUDIES (Theoretical Part): We aim to reunite people who are interested in Neuro-architecture, creating a support network and voluntary collaboration, in order to share and improve contents about the subject, also developing a more humane view of the ambiences.
Through this movement we also reach to encourage the development of researches with Teaching Institutions, spreading the subject, providing knowledge exchange between different groups and applicability of the guide in any part of the world.

2. GOALS OF THE GROUP OF STUDIES (PRACTICAL PART):

The social actions will allow to put into practice and validate the Neuro-architecture knowledge, applying strategies in public spaces, with the possibility of measuring and registration the results, applying technique known by Evidence-Based Design, taking Neuro-architecture benefits to needy community.

3. STUDY GUIDE

The study guide will be divided by semester, to allow the entry of new participants along the year. Each meeting will have a specific subject to be approached with previously defined bibliography, based on reading recommendation disclosed on ANFA website (Academy of Neuroscience and Architecture). At the end of each meeting, it must be registered the knowledge that was discussed in order to be shared with other groups of studies. Each meeting must have a voluntary organizer who will be in charge of the logistics, as well as the registration of the knowledge that will be shared.

4. EXPECTED RESULTS BY THE GROUP OF STUDIES AND SOCIAL ACTIONS:

To the professionals of projects, we hope the application of a way to design based on neuroscientific evidences, stimulating a more humane view of the ambiences and that cause an impact on physical and emotional well-being of the users.
To the community, we hope to allow the access and experience to Neuro-architecture, promoting a better impact of the ambiences in people's lives, also measuring its influence.

SCHEDULE OF STUDY GROUP OF NEURO-ARCHITECTURE 2018- PORTO ALEGRE

MEETING	Attendant	Date	Content	References
1st	Priscilla Bencke, Yasmine Rosa, Rebeca Calheiros	18/1/4	Groups formation meeting and general definitions/application of schedule	
2nd	Priscilla Bencke, Yasmine Rosa, Rebeca Calheiros	2018/29/01	Development of Guide of Presencial Study Groups and development of material to apply for the selection and to show poster to Anfa Conference	Goldhagen, S. 2017. Welcome to Your World: How the Built Environment Shapes our .Lives. - 1.Ed. Harper: 283 p Eberhard, J. 2008. Brain Landscape: The coexistence of Neuroscience and Architecture. 1.Ed. Oford University Press:280p Mallgrave, H. 2011. The Architect's Brain: Neuroscience, Creativity and Architecture. 1.Ed. .Wiley-Blackwell: 297 p Montgomery, C. 2014. Happy City: Transforming our- Lives Trough Urban Design. 1.Ed. Farrar, Strausand Giroux: 368 p. Mora, F. 2017. Neuroeducación: Solo se Puede Aprender Aquello que se Ama. 1.Ed. Alianza Editorial. - Robinson, S, Pallasmaa, J. 2017. Mind in Architecture: Neuroscience, Embodiment and the Future of Design. 1.Ed. The MIT Press: 272 p. Consenza, R., Guerra, L. 2011. Neuroscience and Education: How the Brain Learns. .1.Ed. -Artmed: 151 p
3rd	Priscilla Bencke, Yasmine Rosa, Sandra Cescon de Moura, Rebeca Calheiros	2018/20/03	How the built environment shapes our lives	
4th	Priscilla Bencke, Yasmine Rosa, Rebeca Calheiros	18/4/12	Introduction: Brain, behavior and emotions (Architecture can change the (brain	?Can Architecture change the brain
5th	Priscilla Bencke, Sandra Cescon de Moura, Mander Damasio, Marcio Bartilotti, Bia Rafaelli, Stela Gudolle Ortiz	2018/24/05	Analysis and Discussion about research summary/articles already existent aboute Neuroarchitecture	Applying Neuroscience in Architecture - John EberhardMartin Knoll - Should Architects worry about Neuroscience? - Harry Francis Mallgrave. -To a Neuroscience of Architecture:"mind, imagination incorporated. - Juhani Pallasmas. .(Why) Should Architects worry about Neuroscience? - Michael Arbib
6th	Priscilla Bencke, Sandra Cescon de Moura, Mander Damasio, Marcio Bartilotti, Bia Rafaelli, Paula Zampiva	2018/19/06	Analysis of articles about projects of Neuro-architecture applyed in hospitals around the world	Can the design of space alter stress responses? - Lars Brorson Fich-Designing Happi-" ness: Nature, Light, and Surprise - Rebecca Habtour, Madlen Simon. Designing Multisensory Therapeutic Environments: Invention in the General Hospital of Chania	Greece - Konstantinos- Alketaso. Enriched Environments Enhancing Psychiatric Care Facilities " for Transitional Youth. - Lara ChoW
7th		18/7/4	Technical visit to the Health institution where the intervention will be performed	
8th		2018/24/07	Definition of the theme to intervention in hospitals with the person in charge	
9th		2018/21/08	Discussion aboute neuroscience with a Neuroscientist	
10th		2018/25/09	Presentation of summaries shown in Anfa 2018	
11th		2018/23/10	Analysis of the interventions performed so far with a neuroscientist and a .psychologist	
12th		2018/20/11	Conclusion of the social action/ practical activity and preparation to presentation of results in the final meeting of December rresults of social actions	
13th		18/12/7	Conclusion - National Meeting of Neuro-architecture	

Testimony of Isabela Franco Schreiber, Architect and Town Planner - Member of the Study Group of Neuro-architecture in Porto Alegre/RS
I believe that reuniting the multidisciplinary group has been an important step to transform the perception that people have about spaces and increase the value of professionals who take advantage of architecture to improve people's life quality.

Testimony of BetâniaGuerreiro, Architect and Town Planner - Member of the Study Group of Neuro-architecture in Brasília/DF
Studying human behavior, understanding that physical and chemical processes happen and that the environment directly affects the way we develop, is essential for designing the spaces. The Study Group of Neuro-architecture motivates the constant seek to give people the best that architecture can offer, communicate and potentialize. Therefore we believe that this seed we have planted here has engaged more professionals and we will be stronger together to do our part.

Testimony of Ana Paula Guedes, Architect and Town Planner, in charge for the company NaobraArquitetura – Member of the Study Group of Neuro-architecture in Belo Horizonte/MG
During this short and valuable time, we also evolved here in Brazil. Today, we are many professionals, of many areas, interested in understanding what Neuro-architecture is. Currently, I join a Study Group about the subject. We are still a few and we know that we need investors to be able to contribute in our researches.Also we have gotten surprised how much Neuro-architecture has aroused interest in people who we have talked. Therefore we believe that this seed we have planted here has engaged more professionals and we will be stronger together to do our part.

Testimony of ManderDamásio, Architect and Town Planner - Member of the Study Group of Neuro-architecture in Porto Alegre/RS
I noticed a common feeling among the group: the wish of resignify the architecture we practice, or bringing a bigger and more precious sense to our job.

Testimony of MárcioBartilotti, Architect and Town Planner - Member of the Study Group of Neuro-architecture in Porto Alegre/RS
It is good to be part of the beginning of something that will be great and will positively impact in life quality of many Brazilians!

Testimony of BiaRafaelli, Architect and Town Planner - Member of the Study Group of Neuro-architecture in Porto Alegre/RS
I hope the group improves the comprehension of human answers to the built environment, being able to project assertively aiming people's health and well-being. I believe that biophilic design is one of the ways to design these places. I am really happy to be part and to be able to deepen my knowledge on this field!

After studies made by the group, it was found a huge lack of humanization in hospital areas. Therefore, we will start our practice in hospitals.
The first intervention to be performed will be in a hospital room, through application of wallpapers or paintings on the walls and roofs. We established this way of intervention to avoid any change or damage to the place.
This action will be performed in small scale aiming to accomplish accompaniment and to obtain results in the year of 2018.
The way to make feasible this practice will be through the search of assistance of local medical staff, so that we can follow and assess the benefits of the action.
With the practice, we aimto reduce the time of permanence of the patients in the hospital, physiological records and reduce the amount of painkillers that are consumed.
We are looking for sponsors to perform the interventions to enable the practice


STUDY GROUPS PORTO ALEGRE RS


STUDY GROUPS SÃO PAULO SP


STUDY GROUPS BRASÍLIA DF


STUDY GROUPS SANTA MARIA RS


STUDY GROUPS BELO HORIZONTE MG

Consenza, R, Guerra, L 2011. Neurociência e Educação: Como o Cérebro aprende. 1 Ed Artmed 151p
Eberhard, J. 2008. Brain Landscape: The coexistence of Neuroscience and Architecture. 1 Ed. Osford University: 280p
Goldhagen, S. 2017. Welcome to your Worls : How the built enviranment Shapes ou Lives. 1 Ed. Harper: 283p.
Malligrave, H.2011. The Architect's Brain: Neuroscience, Creativity and Architecture. 1. Ed. Wiley - Blackwell: 297p
Montgomery, C. 2014. Happy City: Transforming our lives Trough Urban Design. q. Ed. Farrar, Strau and Giroux: 368p.
Mora, F. 2017. Neuroeducación: Sol se puede Aprender Aquello que se Ama. 1 Ed. Alianza Editorial
Robinson, S, Pallasmaa, J. 2017. Mind in Architecture: Neuroscience, Embodiment and the Future of Design. 1 Ed. The MIT Press: 272p
AUTHOR BIOS
PRISCILLA BENCKE Specialist in Worplace Design (Gepr. ArbeitsplatzExpertin / Geor. BoroEinrichter-in - Germany) Qualiti Ofiice Consultant.

The Student Experience: The Future of the Academic Library

Authors: Mark Thaler, Maddy Burke-Vigeland, Kimberly Hickson, Ben Regnier. Affiliations: **Gensler**

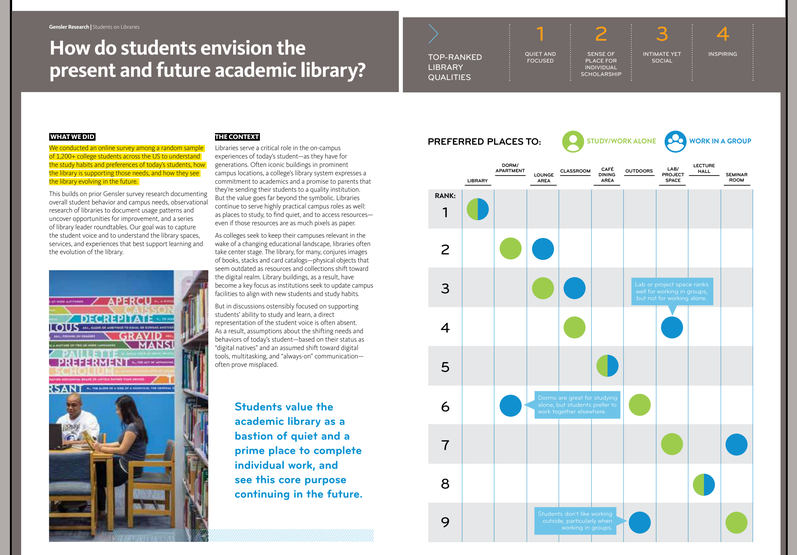
Abstract

How are academic libraries currently being used? What spaces are popular? What kind of activity is taking place? How much has technology penetrated this ancient space? What inferences can we draw from these observations that can help drive the design of future libraries? While there is a wealth of intuitive knowledge about use patterns in academic libraries, there is very little observational study of how these critical spaces are actually used.

Using digital observational tools that allow for direct recording of use space-by-space over time, Gensler has conducted a "time lapse" site surveys of a wide variety of college and university academic libraries, observing focused and collaborative activity, space qualities, and tools used. Direct observational data collected hourly over several weeks at each site provides data on occupancy, activity, and context. Combined with student and faculty surveys, and librarian round tables, this has provided insight into not only use patterns and occupancy rates, but how students and librarians differ in how they perceive the value of the academic library.

Preparatory Research

A survey of a random sample of more than 1,200 college students across the US produced a "priority list" of places students preferred to study, as well as a list of most-valued qualities in an academic library. **Students clearly valued the academic library as a bastion of quiet and a prime place to complete individual, focused work, and see this core purpose continuing in the future.**



Methodology

Using digital observational tools that allow for direct recording of use space-by-space over time, Gensler has conducted a "time lapse" site surveys of a wide variety of college and university academic libraries, observing focused and collaborative activity, space qualities, and tools used. Direct observational data collected hourly over several weeks at each site provides data on occupancy, activity, and context. Combined with student and faculty surveys, and librarian round tables, this has provided insight into not only use patterns and occupancy rates, but how students and librarians differ in how they perceive the value of the academic library.

The collection of academic institutions was broad, ranging from community colleges to 4-year research universities, and the results were likewise diverse. Each library performed onsite observations over a two week period from opening to closing using "Wisp" a mobile digital site observation tool developed by Gensler. While the exact time of year was not identical for all studies, observations were done during the standard academic calendar for each institution, and did not overlap with break or exam periods.

Contributing Libraries
University of San Diego
London Metropolitain University
Columbia College - Chicago
San Jacinto College - Houston
The Jewish Theological Seminary - New York
Gonzaga University

Conclusions

LIBRARIES ARE ABOUT MORE THAN BOOKS.

For students—yesterday's, today's, and tomorrow's—the core purpose of the library is its physical and symbolic presence as a place where scholarship is supported and respected. Students, even those not looking for books, continue to seek library spaces as the place to complete their individual work.

YOU CAN INCREASE CAPACITY WITHOUT INCREASING SPACE.

Money and space are both at a premium—opportunities to better leverage existing resources and facilities are necessary to keep libraries relevant and performing at their best. By prioritizing the favored workspace types, you can serve more students in the same amount of space.

INDIVIDUAL WORK SHOULD BE THE PRIORITY.

This doesn't mean giving everyone an enclosed room. The utilization rates of study stations and open seating arrangements in our investigation illustrates the point—both are largely open, but study stations provide clearly defined individual work areas and are occupied at twice the rate of open seating on average.

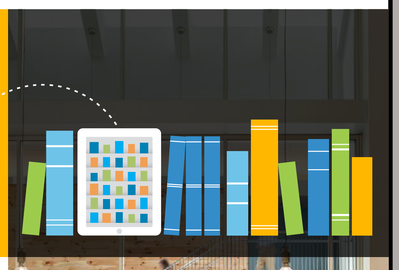
YOUR LIBRARY HAS A RHYTHM OF ITS OWN.

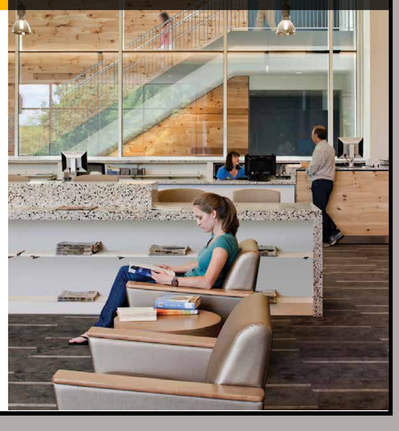
Understanding the rhythm and current utilization patterns of a library is an opportunity to realign spaces to best support student demands—increasing the opportunity for them to find the spaces they need by maximizing the spaces available.

PERSPECTIVES

The Association of Research Libraries tracks resource spending at top academic libraries across the US, and has noted a marked shift toward electronic materials.

"Not only have electronic materials expenditures grown sharply in the past two decades, they have grown at a rate far exceeding that of library materials expenditures overall ... anywhere between two and ten times faster than total materials expenditures have grown."





WHAT'S NEXT

To understand how tomorrow's libraries can better support evolving student needs, we are launching a nationwide survey of college students to understand how they're studying and using the library today and their preferences for the future. Our team is also exploring hybrid space and furniture typologies to better address the tension between spaces intended for individual work and those meant for group work. We believe these hybrid solutions are necessary to support the changing activities libraries must accommodate over the course of a day, week, and school year—allowing changes in use to occur in real time with minimal rearrangement of furniture.

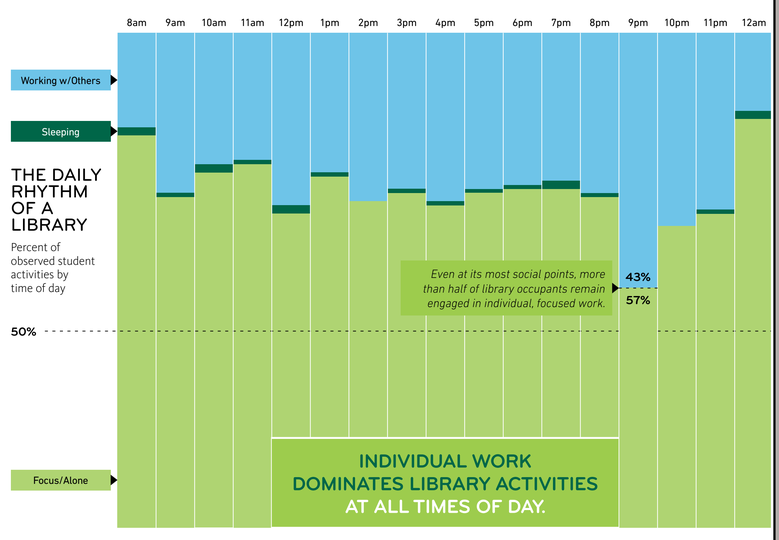
Results

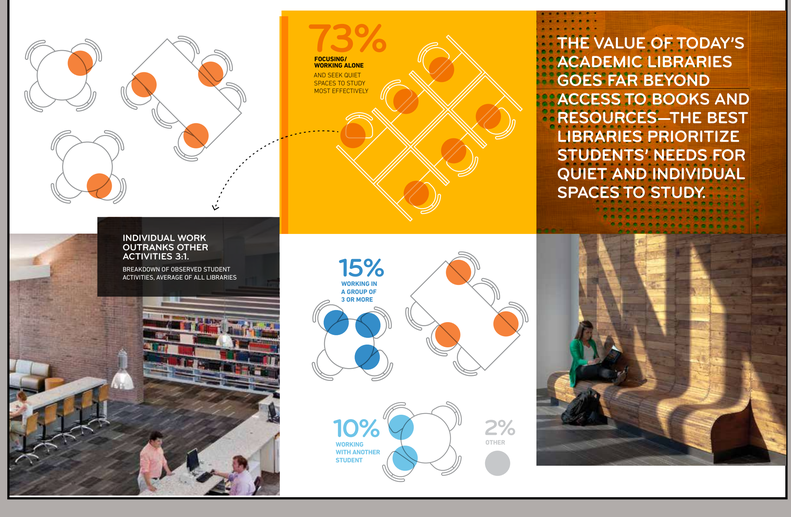
The dominant finding was a confirmation, supported by surveys and interviews, that individual focus work is still the dominant use of libraries, with 73% of students and faculty performing this activity. Despite this finding, the most common seating type observed at these libraries was aggregate seating at large tables. **Visitors to the library performing focus work were unlikely to sit at a 4 or 6 seat table if another student had occupied the table, even when the library was acting "at capacity."** When study carrels or divided tables were provided these were far more popular as they are designed to support focused activity.

Group work was also common, with 10% of observed users working in groups of 2 and another 15% in groups of 3 or more. The most popular locations for group work were in dedicated conference rooms or in informal lounge areas outside the main stacks, not the large tables mentioned above.

Tool use confirmed the librarian "common sense" answer provided in round tables that, while computers and digital devices are very common, many students still use physical books and pen and paper in library activities. Physical note taking with digital reading was the most common combination observed. This accommodation of both digital and physical tools is a key aspect library use that should be highlighted.

The study also tracked access to amenities (food, power, daylight) to attempt to see if any of these factored into seat choice. No observable connection was found, instead the seat type and privacy or suitability to activity as mentioned above was the primary driving factor. This suggests that providing furniture more closely matched to user needs could help drive occupancy for the academic library.





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Thaler, Mark et al (2015). Librarians on Libraries. Gensler Research, retrieved March 3, 2018 from https://www.gensler.com/research-insight/gensler-research-institute/librarians-on-libraries

Thaler, Mark et al (2015). Students on Libraries. Gensler Research, retrieved March 3, 2018 from https://www.gensler.com/research-insight/gensler-research-institute/students-on-libraries

Shifting Teacher Practice in an Innovative Learning Environment

Abstract:
Research shows that many schools continue implementing traditional pedagogy, despite inhabiting spaces intended to support a variety of teaching and learning opportunities (Saltmarsh, Chapman, Campbell & Drew, 2015). This disconnect is not surprising as teaching is already complex and the innovative learning environment (ILE) designs today often increase this complexity. Regardless, responding to evidence that ILEs do correlate to student deep learning and teacher mind frames (Imms, Mahat, Byers, & Murphy, 2017), more schools are trading in their identical classroom models for multi-modal, flexible, technology-infused facilities with hopes of spurring pedagogic shifts.

The research presented here stems from a sub-project of the Innovative Learning Environments and Teacher Change (ILETC) research study at the University of Melbourne, completed through a Fulbright Postgraduate Scholarship (French, 2018; ILETC, 2018). The research goal was to understand the ongoing transitions (i.e. changes in behavior) made by teachers inhabiting these new spaces to inform future strategies and tools to quicken and ease the transition for future teachers. To this end, four exploratory case studies were completed on schools making the shift from traditional to innovative facilities in Australia and New Zealand asking the question, "What characterizes a successful transition of a school from traditional classrooms to an innovative learning environment?"

While multiple examples of the symbiotic relationship of space and behavior were seen in the data, one of the most prevalent findings was encompassed in what this paper calls, "enabling constraints," e.g. the purposeful removal of common artifacts of schooling, such as desks, singular teaching walls, books, etc., to spur the desired shifts in teaching and learning behavior. The perception of these design decisions, when paired with intentional organizational structures and routines, shifted from constraints to enablers as educators inhabited their new facilities. The intentional alignment with organizational supports was crucial for the enabling constraints to convert short term behavior change into more long term shifts in practice. It was clear that school leaders, designers, and educators should consider the entire ecosystem in which behavior is occurring, accounting for the unintended removal of needed affordances (e.g. removal of teacher storage along with the desk) and the recipients' mind set regarding the constraint's intent.

Borrowing from Nudge Theory (Thaler & Sunstein, 2009) and Dynamic Social Impact Theory (Latane, 1996), this research discusses these enabling constraints as a method to increase teachers' self identity and the school's organizational identity as collaborative, one of Hattie's mind frames (Hattie & Zierer, 2018) and a key assumption for the successful inhabitation of an innovative learning environment.

Matrix of alignment and misalignment between the design and use of schools

Student-Centered Practice in an Innovative Learning Environment
Affordances within the learning environment are realized by the users.

Teacher-Centered Practice in an Innovative Learning Environment
Affordances in the built space go unutilized, sometimes with obvious adaptations suggesting misalignment.

		Multi-modal instruction	More use of shared professional spaces	Student differentiation	Movement	Team teaching	Self-regulation of behavior	Regular teacher communication	Student agency		
The removal of teacher's desk in classrooms	...has the potential to increase...		●		●			●		...by constraining teachers' ability...	to complete independent tasks in their classroom and sit in one place while teaching.
Increasing space utilization			●					●			to stay in one classroom all day and manage time independently.
Providing a variety of shared space types		●		●	●	●		●	●		to stay in one mode of instruction all day and manage use independently.
No individual storage in classrooms					●			●			to individually store one's materials.
Multiple classes sharing one larger space						●	●	●			to teach autonomously and manage activities independently.
Visibility into other classrooms		●						●			to remain unaware of other teachers' practices.
Not streaming students				●					●		to maintain identical expectations for all students.

Table 1: Examples of enabling constraints and potential impact on teacher behavior

Nudge Theory acknowledges that humans are not always rational when making decisions. Instead, we often automatically respond to the design of the situation regardless of logic or spoken intent (Thaler & Sunstein, 2009). Nudges are intentional interventions to the design of the situation meant to guide the recipient towards the desired choice. This study recognizes the opportunity to reframe discussions of ILE designs as a series of "nudges" towards the desired shifts in teaching practice.

We know:
- People revert to their default when faced with complex situations (Mols et al., 2015)
- ILEs are unfamiliar and complex (Alterator & Deed, 2013)
- Teachers often revert to the traditional if there's no training (Beery, Shell, Gillespie, & Werdman, 2013) and/or lack of aligned structure (Saltmarsh et al., 2015)

Oftentimes, many traditional artifacts of schooling remain a part of an ILE design in the name of flexibility. For example, designs may have both a classroom for every educator and additional space types or a school may provide both a teacher's desk in the classroom and additional planning spaces. However, it can be argued that due to their physical presence and ease of accessibility these traditional design elements become obstacles to change and we should be more intentional about the affordances provided in an ILE.

How can design serve as "nudges" to make ILEs less complex and encourage shifts in teaching practice?

Consistent experiences over time alter one's identity (Roberts, 2006). Simarly, cultures arise from everyday interactions of people located in space (Latane, 1996). We can thus assume a relationship between the creation of one's self identity and the cultural/organizational identity of which one is a part.

In the context of a school, a teacher's professional identity is partly shared by the other teachers with whom he or she works and is viewed as:
1) collective - formed through shared norms and standards,
2) singular - unique to the individual teacher based on specific history and training; and,
3) relational - reacting to the interactions with and perceptions of other teachers (Cattonar, Draelants, & Dumay, 2007).

The intensity of interaction (by proximity and number) has shown to positively correlate with the importance of socialization at the school level (Cattonar et al., 2008). Basically, the more communcation occurs, the more it is valued.

If we create an environment (physical and organizational) in which teachers communicate and observe one another more often, can we increase their collaborative professional identity and the school's collaborative organizational identity?

Combining Nudges with Identity Theories
The most cited behavior shift linked to enabling constraints is the increase of regular teacher communication. The model to the right proposes that relations between teachers (i.e. regular communication/observation) can help a teacher identify as a more collaborative individual (i.e. "I collaborate") and, if it happens often enough to enough teachers, can lead to the school itself making collaboration a norm (i.e. "We collaborate"). Design and organizational decisions, encompassed in the concept of enabling constraints, are viewed as a moderator to increase regular communication and observations of practice leading to the shift in professional and organizational identities of teachers and the shift in mind frame from autonomous to "I collaborate".

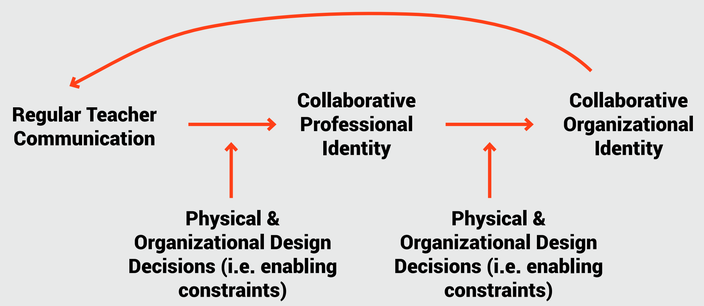

Figure 1: A model of enabling constraints to increase teacher collaboration

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DLR Group
Australian Government
Australian Research Council
THE UNIVERSITY OF MELBOURNE
iletc INNOVATIVE LEARNING ENVIRONMENTS AND TEACHER CHANGE
A 2016-2019 ARC LINKAGE PROJECT

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Childhood Memories and Their Influences for the Architect's Cognition

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Research studies in psychology explain that we are influenced by our social environment from childhood, especially by our parents or by the persons we grew up with. Unless we try to change ourselves in a conscious way, the influence will follow us the entire life. But does this also apply to the build environment? How does the brain of the architect function? Are his childhood memories and the environment he grew up in linked with his way of approaching architecture?
In our study, we are trying to answer to the questions above by using two methods: the interview and the survey, applied only to architects.

Interview: Juhanni Pallasmaa (Finland) and Dorin Ștefan (Romania)

The first method I employed is the interview. To this purpose, I selected two of the most authentic contemporary architects and challenged them to speak about the influence of their childhood environment on their brains and on their cognition. The first one is Juhanni Pallasma (1936), a Finnish architect, whose theoretical works are widely appreciated, especially in the field of environmental psychology. The second one is Dorin Ștefan (1950), a Romanian arhitect, who revolutionised the architectural scene in Little Paris (as Bucharest is known), both as a practitioneer and as a professor using his highly creative approach, always orientated towards the future. They might seem to sit at opposite sides of the spectrum at first glance, but what they have in common is a true passion for improving human life through architecture, each of them in their very own way, on through empathy, the other through innovation.

A. M. : What is the influence of the build environment from childhood, on the brain of the architect and for his future architectural creations?

J.P.: *I am responding to your question as an architect and writer, not as a psychologist. As the human brain and neural system develop and are tuned by genetic coding and interaction with the environment and life situations, i. Biographers of artists and other creative persons frequently emphasize childhood experiences. However, human mental development is so complex and subtle, that correlations should be made carefully. The neurological impact of environments was suggested by Richard Neutra in his pioneering book Survival Through Design of 1954: "Today design may exert a far-reaching influence on the nervous make-up of generations". This architect´s assumption has been verified by science decades later, and Fred Gage, neuroscientist claimed in 2015: "Changes in the environment change the brain and therefore they change our behaviour. In planning the environments in which we live, architectural design changes our brain and our behaviour".*

I wish to say personally, that the stimuli and influence of my early childhood at my farmer grandfather's humble farm in Central Finland, during the war years of 1939-45, were crucial. These experiences were pushed aside from my consciousness during the decades of my professional growth, but the significance of the early life in the farming environment has become clear to me by age. I am particularly grateful for my five years of solitude (I was the only boy of my age in the farming community), which guided me to observe nature, the farm surroundings and everyday life, including animal behaviour. Those years avoke my sense of curiosity, which still continues at my current age of 82. Also the natural integration of everything in simple farm life probably had an influence on my life-long interest to seek interactions and relations across borders and categories. I also still have vivid embodied feelings of homeness, protection, solitude and silence from my childhood. In the farm setting, as well as the small industrial communities, in which we lived after the war, the traditional buildings and settings were haptic, rather than visual in their essence and qualities. I still recall how the rooms of the house, the sauna, the cow house and the barns felt to the skin and smelled more than their visual appearances. I believe that my interests in the significance of touch and the hand derive from my early experiences of making – my grandfather gave me my first sharpened carving knife at the age of five. Almost everybody in the traditional farm life was capable of making and doing whatever was necessary in life. There were only three professions in my childhood world: the priest, the black smith and the teacher.

I can also remember the endless periods of boredom of the lonely boy, as there were no books, radio, television or playmates. But, I believe that this everyday boredom activated my imagination. As a consequence of my personal experience, I consider today's perpetual over-stimulation of a young child as a cardinal error. Children need to be bored in order to develop their inner world, imagination and capacity to dream.

A.M. : Do you think that your career as an architect was influenced by the built environment you grew up in?
D.Ș. : *No, I think not, maybe quite the opposite – I went for glass, metal, apparent concrete instead of brick, clay and tiles.*
A.M. : What would you say now about your childhood spent in a fairly big household in a mountainous area of Romania in that particular period?
D.Ș. : *I can't say I enjoyed it that much, there was too much physical labor involved, which occupied too much of my time, so I didn't really have time to play. Later, in high school, when my parents gave me carte blanche to learn, I used this respite from physical work to read and study.*
A.M. : What can you tell me about the continuous process of change that your childhood home underwent. Your home was a constant work in progress. In your book you name this process 'Odyssey', which I assume has a special meaning for you.
D.Ș. : *The long andt permanent process of building work which goes on even today through my sister and my niece can be traced back to my parents' financial means. The Odyssey was, at least for me, about the permanent state of siege that I was under; on all my holidays and Sundays there was always something to work on and I was 'busy' against my will.*
A.M. : You accompanied your father to the Râșnov Tool Factory and became accustomed to metal as a material. Could your passion for technology and manufacturing stem from this?
D.Ș. : *Yes, it was something important, it mattered to me; technology was superior to all other 'realities' around me and day to day activities. That's where the money came from and I believe there was also a fascination that came from the factory's importance (it was big, there were a lot of people - it was a universe in itself).*
A.M. : Can you think of a pleasant olfactory memory from your childhood that instantly makes you think of home? How about an auditory one?
D.Ș. : *As I'm not a foodie , I don't think it's the smell of Easter sweet bread or my grandmother's cooking; it may be the smell of charred pig (charred on straws). A pig would be slaughtered and charred it in the courtyard at home for Christmas.*
As for sound, this would be the thundering, deafening noise that calcium carbide makes which I used to hear on the Eve of Easter. Children used a metal container with a wooden cover/lid and with a small opening at the bottom, from where fire was lit; the gases emanated by the calcium carbide would explode and pop the wooden lid open with a bang.
A.M. : Where does the thirst for authenticity and the desire to spearhead new currents and approached come from?
D.Ș. : *It comes from the Transylvanian spirit, with its love for the authentic, the 'truth', intrinsically linked to the idea of good tradespeople, very handy with things, with 'hands of gold'. The avant-garde spirit is also to be traced back to the rejection of norms and rules (I don't quite know where this comes from); or it may come from cultural accumulation, from the openness of the period when we embraced the interwar avant-garde again (Ion Barbu, Lucian Blaga, Constantin Brancusi, Matti Teutsch).*

Even if their approach to architecture might seem opposing at a first glance, both Juhani Pallasmaa and Dorin Ștefan chose to speak about the importance of developing a sense of curiosity since early childhood, the need for connection and affiliation to a community, but also of the perks of the haptic experiences. Concluding these two wonderful interviews, we can indulge in a moment of reflection, as to acknowledge how beautiful is the human brain, as to allow us to manifest in so many different ways, but at the same time, we can realize that our final main goals, aren't so distant, one from another. We all strive for finding our own authentic self, either in continuity with our childhood, or flying in the other direction, with boldness and curiosity. Attitudes which can be so visible, when translated into an architectural vocabulary.

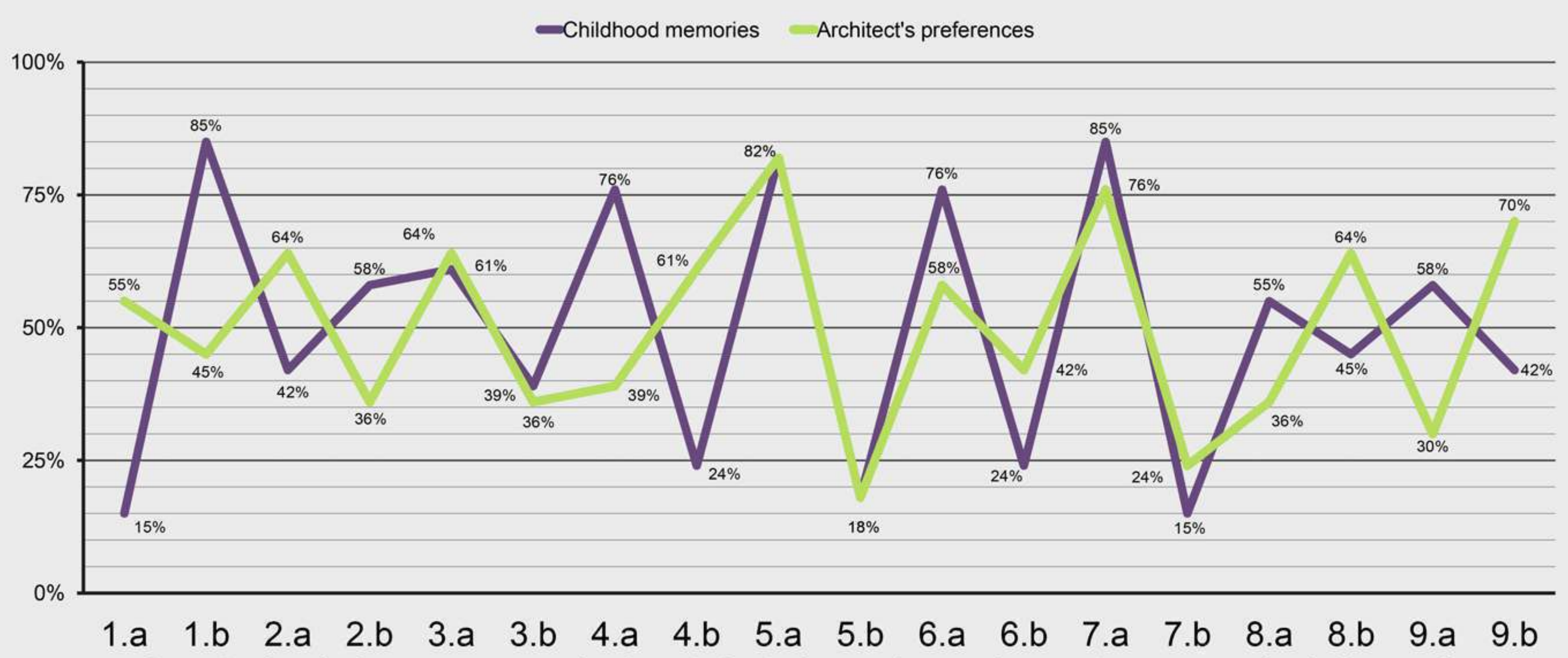
Survey: Childhood Memories and Their Influences on the Architect's Brain

Survey Aim:
The final aim of this study is not only to discover if the architect's brain is influenced by the built environment from his early life, but also to identify in which manner do these connections influence his architectural prefferences, which later on will impact his design approach. Moreover, by understanding the experiences embodied in one's childhood, we as architects could tackle differently the designs we propose.

Method:
The Survey was given to 33 architects (23 women and 10 men), aged between 23 and 55, from all regions of Romania.
The survey also included two more questions, regarding their olfactive and auditive memory. I will share with you a few of their responses.

Do you remember any particular sound in your home? *The sound the doors were making when they were being closed, or when they were closing/slamming by themselves. The apartment has a double orientation, thus the circulation of air caused the windows and/or the doors to close by themselves. Laughter. Steps on the wooden floor, raining drops on the roof, fireplace sound in winter. Children's laughter from the nearby school. Birds singing.*

Do you remember any particular smell in your home? *The smell left after the hallway's floor was being swept and washed. My mom cooking. The fresh smell of the sea breeze each time it rained, especially during the cold seasons. I had a big wallnut tree that was part of my childhood with all its smells. The smell of the old books in the balcony.* Bananas in a cupboard, left to ripe for Christmas (in an era when we did not had access to bananas).

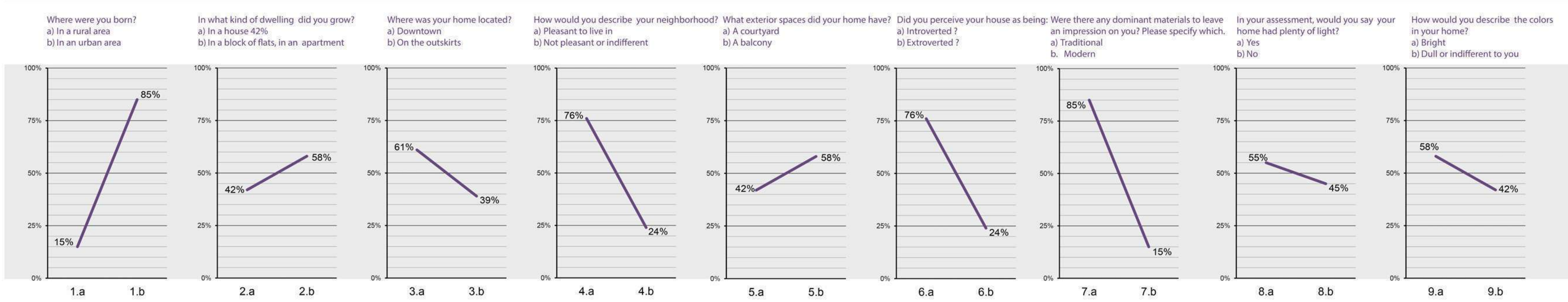


Each question from the first survey corresponds to its equivalent in the second survey. The memories are compared to the future prefferences.

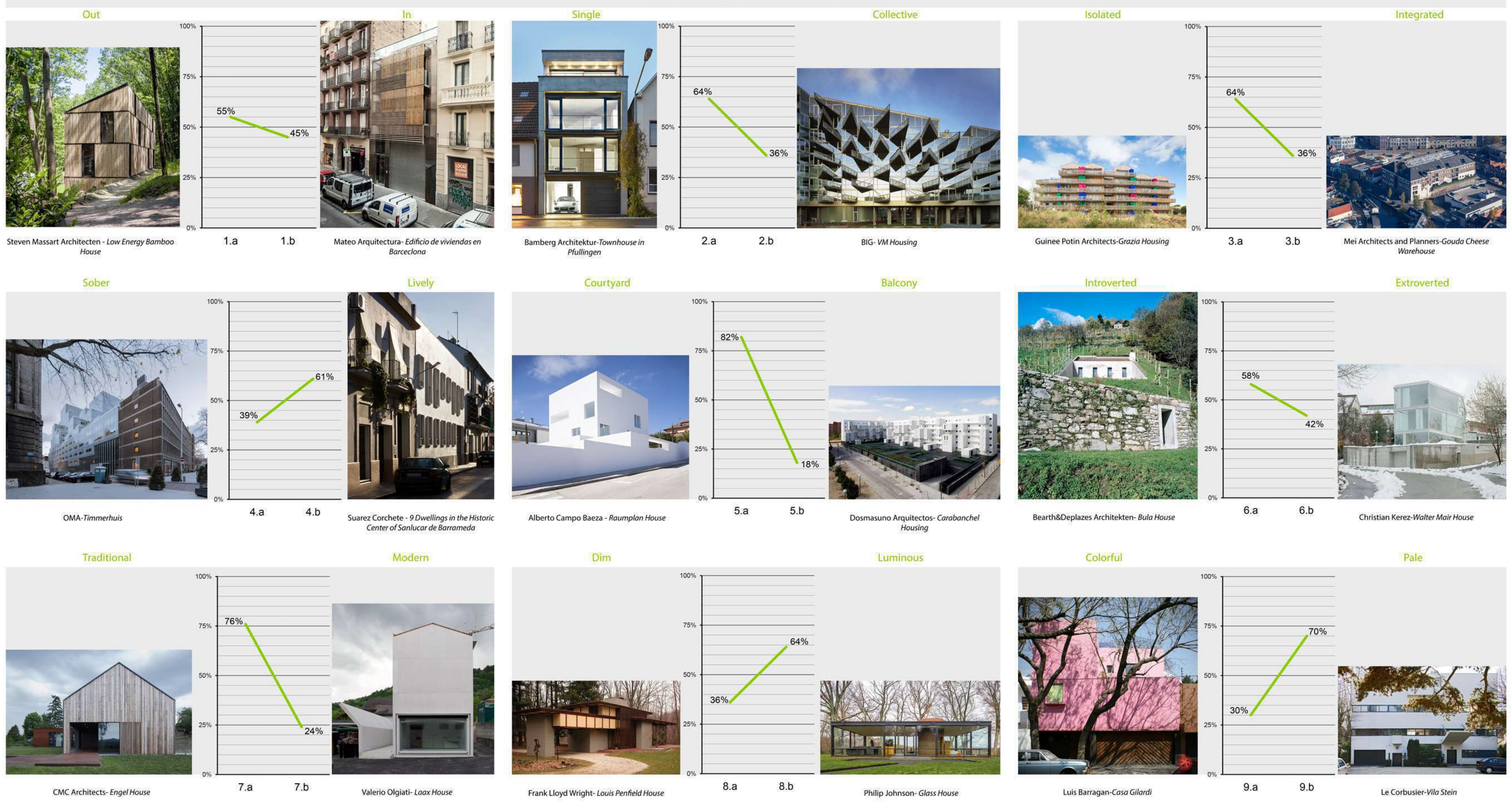
Results:
Romanian Architects preferred environments in more remote areas, more tranquil, even in the majority of them were born in urban settings.
Romanian Architects preferred individual houses rather than a collective housing unit, and courtyards to balconies.
Romanian Architects preferred introverted houses, rather than the extroverted ones, preference which was clearly influenced by their childhood environment, perceived as introverted for the majority of them.
Romanian Architects preferred traditional materials, rather than more modern ones. They choose wood in a proportion of 36%, brick 12%, plaster 24%, textiles 39% in contrast with the metal which had only 3%, apparent concrete 6%, glass 3%.

Conclusion:
The need for peace and "boredom" which Pallasmaa speaks about, is proved by the results of this survey. Architects need it, consciously or not. If it was not convincing enough, the Romanian architect's preference for introverted spaces, comes to emphasize once more the idea of time spent in solitude in contemplation, in order for the brain to have the chance to develop a sense of curiosity, creativity, self-awareness and consciousness. The idea of reconnection with one's self, through nature and healthy environments, is strengthen by their choice of natural materials, and the need for more light, light which is so beneficial for the circadian system. On the other hand, this seclussion, taken to extreme is detrimental for the community, which is so visible nowadays, in Romania. A ballance between these two extremes must be found.

Survey: Childhood Memories



Survey: Architect's prefferences



From the interview and survey, we can CONCLUDE that the environment from childhood does have an influence on the (Romanian) architect's brain, and on his preferences regarding architecture. He is either choosing a contrasting lifestyle, in comparison with the one he had in his childhood (which comes from curiosity or a need for exploration, or filling an empty space, we don't know yet), or in some cases he chooses not to detach from a familiar way of living, proof of a culture orientated more towards tradition, rather than progress. We are looking forward to continuing this study, in order to compare these results, with other countries in the world, and also with people who don't have any bond with the field of architecture.

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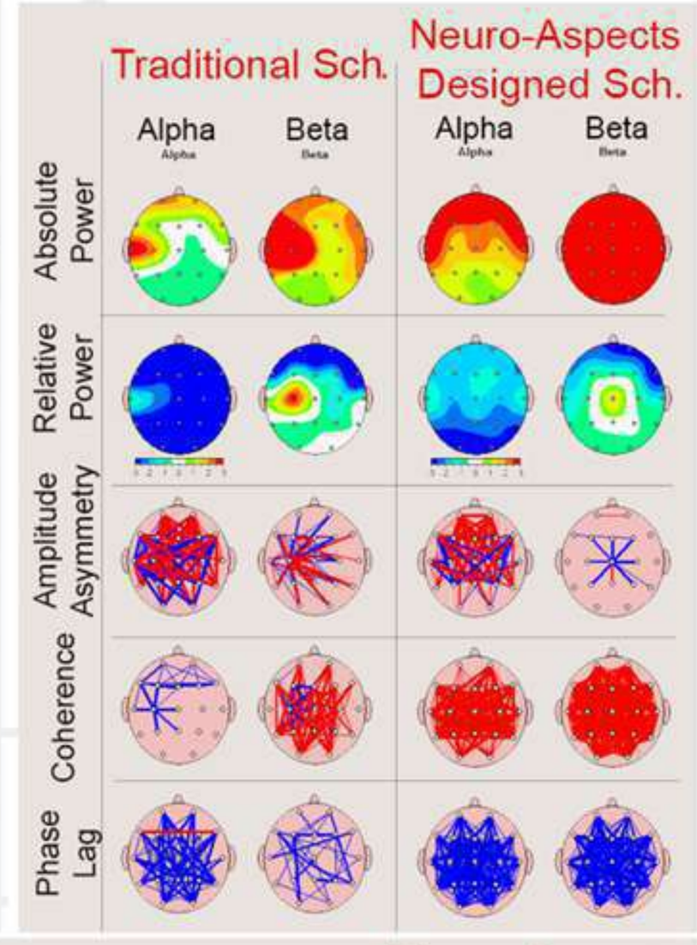
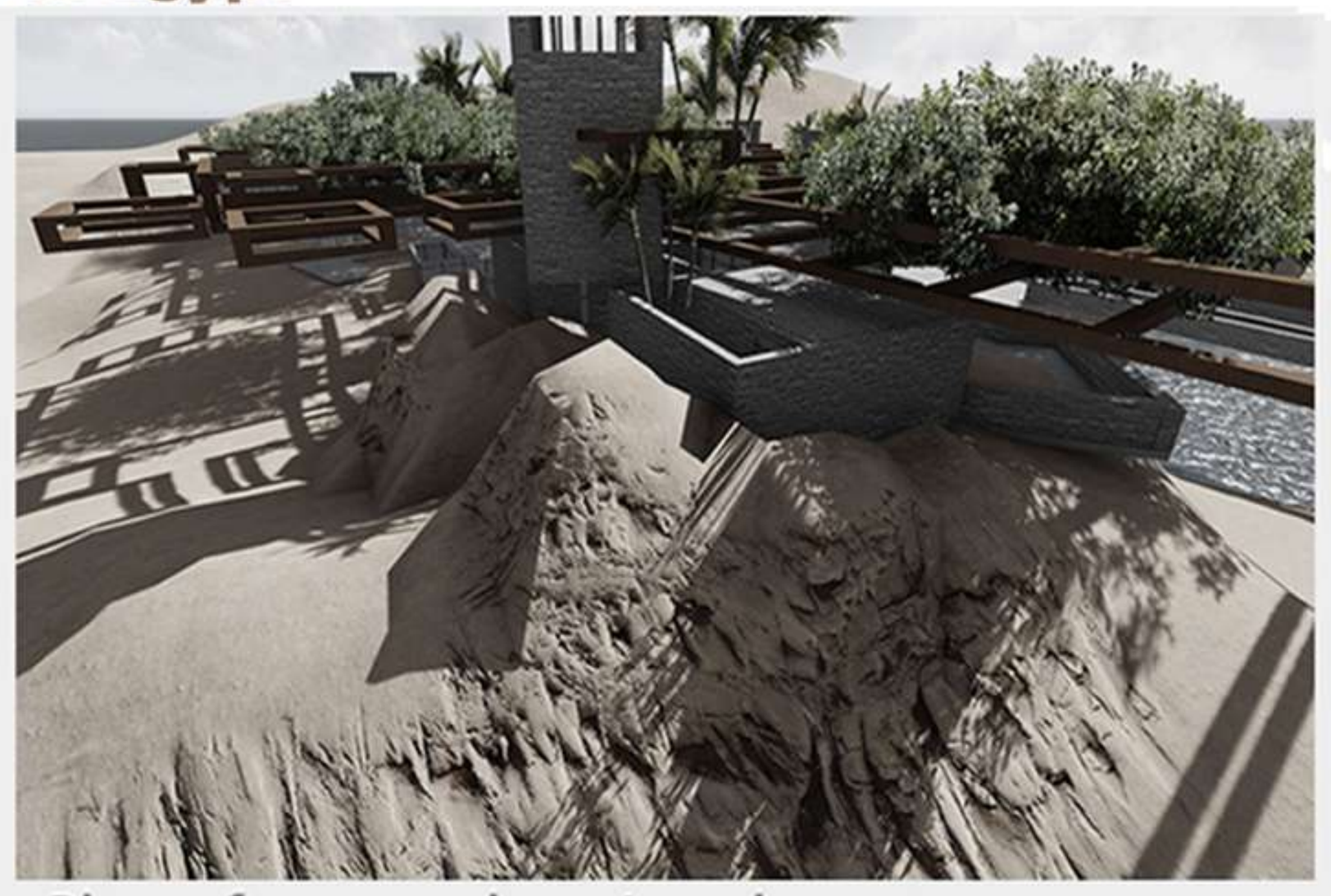
A School designed to improve student's brain activity using integrated Neuro-architectural design aspects ((QEEG-VR))

Mahmoud Ragai Turk, Designer of the school project
Architectural designer in A.C.H, Grad student, Department of Architectural Engineering In Future University In Egypt
Ahmad Amr, Virtual Reality Designer of the school project
Virtual Reality Designer in A.C.H , Grad student, Department of Architectural Engineering In Future University In Egypt
Osama Al Rawi,Research Supervisor
Professor of Architecture, Department of Architectural Engineering In Future University In Egypt

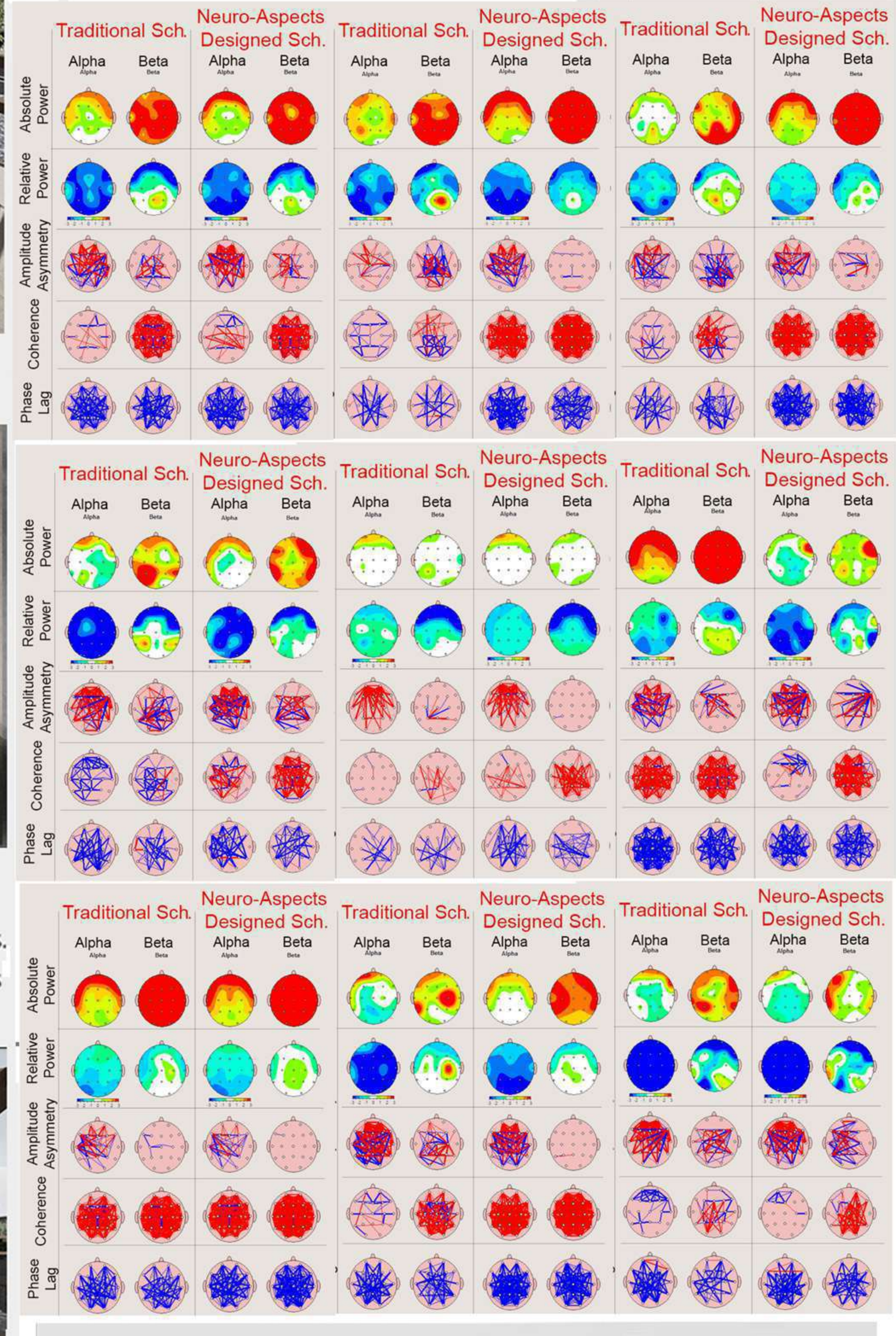
-Landmarks , Symbolism , Form And Aesthetics,



Neurogenesis : Directionality language



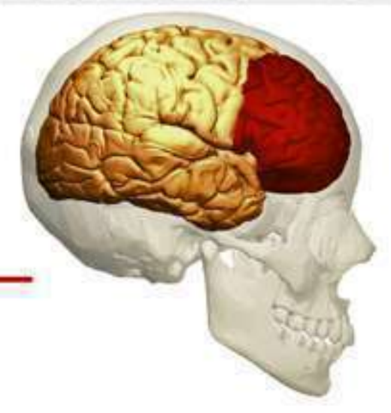
-Places for group learning alcoves
-Accoustics = Feeling of calm



-Neurogenesis: Exposure to enriched environments increases the birth of new neurons
-Sensory-rich environments stimulate memory and learning
-Environmental quality control
- Color and texture should be rich

-Harmony wi nature and architectural designs elicits more positive brain responses than those that are clearly nonharmonious.
-Views of nature deeply affect the cognitive processes of children

Abstract



Purpose

Here we demonstrate a recorded (EEG-VR) method to improve middle school student's brain activity (11-14 years) through designing the learning environment by integration of different Neuro-aspects by practical application. So that A middle school was designed as an application of the following design methods. 1.2.Methodology / Procedure Purpose

-The Research Aim

Improving student's brain activity by urban spaces are designed by different design aspects

:

:1-Physiological Environmental Green Aspects
Environmental interaction & Control (Exposure to enriched environments increases the birth of new neurons (Neurogenesis)+Air quality & distribution+Sun+Acoustics+Day lighting+Temp+River+ Natural materials+Sensory rich-environment+Shade & Shadow+courtyards

:2-Aesthetics and golden ratio Aspects
Void Boxes+Ratios+Angles+ Bio geometry Principles

:3-Emotional Design Aspects
Directionality+Places for group learning—alcoves+Different Levels,Shapes,-Sizes and Views+Void boxes+Diversity+Landmark+Symbolism+Out & Indoor interaction between spaces+Contrast between solid & void+Harmony with nature+Movement & experience Individualization: Low Space Density, Inap-(propriate Scale, Personalization, Flexibility

:4-Archeoastronomy Aspects
Linking the buildings to Orion Nabula by shafts directed to it (Multidimen-(sional power spots

5-Biogeometry Aspects Ratios, rotation, interfacing, shifting and transparen-.cy

-Different Levels , shapes and size
-Connection between out and in door & interaction between spaces all senses formulating
-High contrast between solids -Diversity language

-A child's brain responds to natural daylight and shadow
- Fresh Air

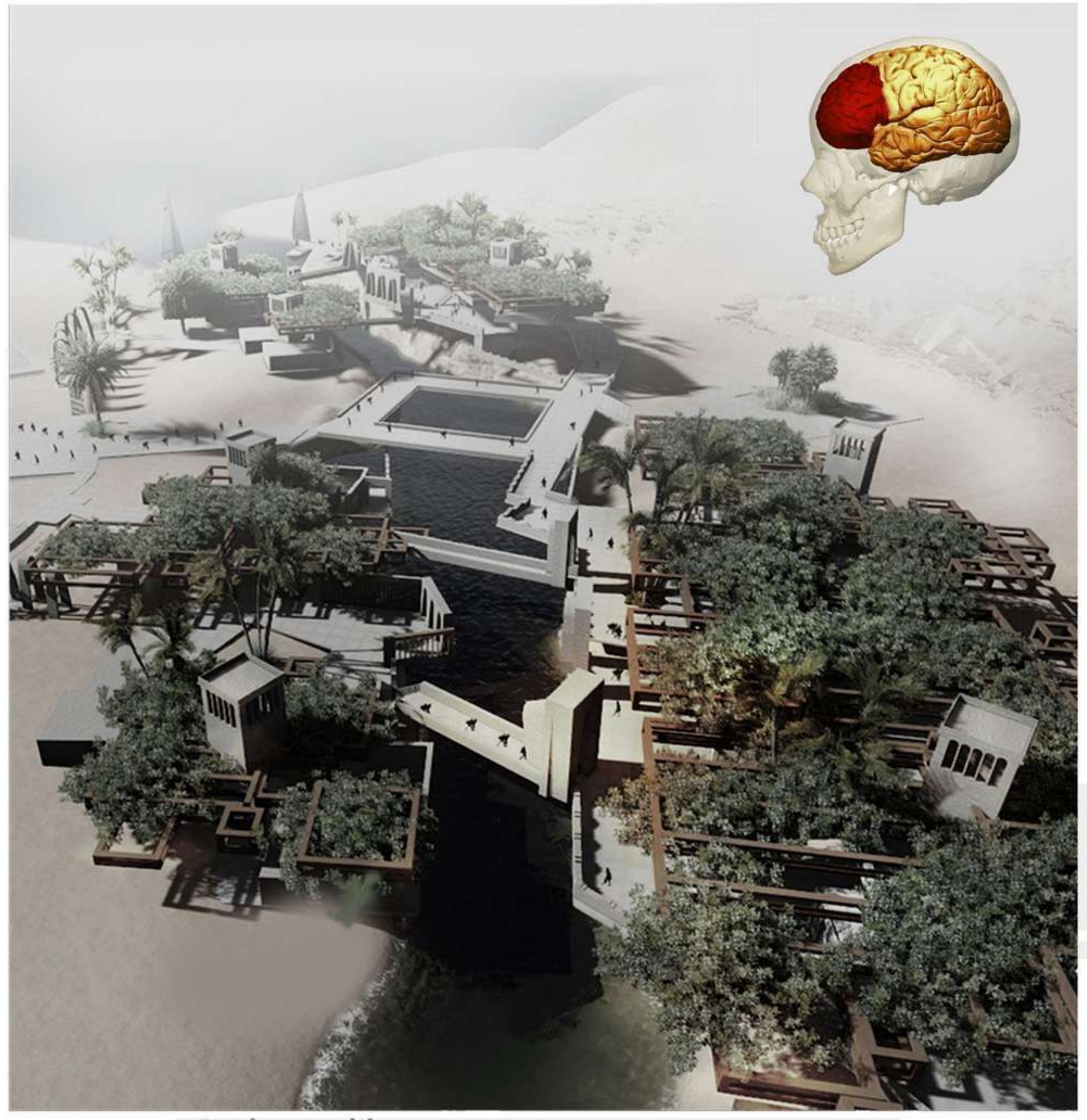
:The Evaluation Process

QEEG recording during virtual reality simulation was tested on 10 middle school stu-'dents

-Inclusion criteria: · Age 11:14 years-Normal IQ-No medical comorbidities. Acceptance of enrollment

:Outcome / Discussion :

The measurements of QEEG recording during Virtual reality simulations for 2 models (Traditional school Vs Neuro-Aspects designed school) showed that 80% of the cases had the frontal lobe activation Which has been reflected by the increase of alpha and beta waves in the frontal areas in their brain, And It has been scientifically proven that the frontal lobe is responsible for concentration, attention, problem solving and judgment of things, The measurements also showed that the brain produced alpha waves and produced less beta waves, It has been scientifically proven that beta waves express the concentration, focus, cognition and the five physical senses Therefore the alpha and beta waves indicates the person's willingness to receive information



-Orchestral homogeinity
-Movement , Experince And physiological interaction inside nature and environment

Nature Is Restorative

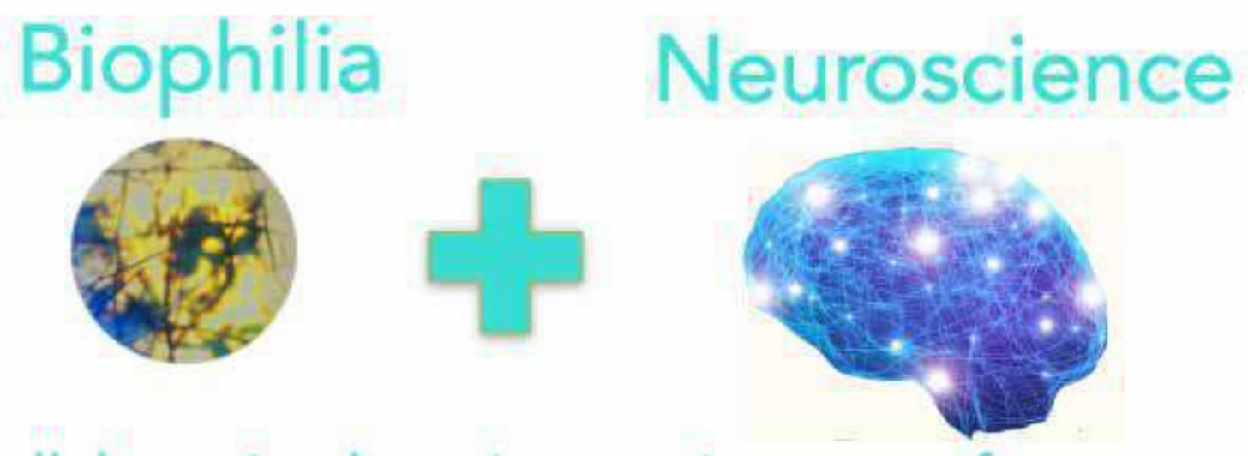
A model for a therapeutic, collaborative learning environment for teenagers that incorporates biophilia and neuroscience research to encourage learning and well being.

J. Susan C. Marano

Washington State University

Hypothesis/Problem Statement

There is emergent knowledge about how the built environment affects our neuro function. We know that the brain responds positively to nature and to physical movement. Designing around this known literature will improve learning processes.



= A collaborative learning environment for teens that promotes improved neuro-function.

Thus, this design is grounded in principles of Biophilia (the human affinity to nature) and related knowledge around neuro function and learning.

Framework Questions:

What does Literature say about nature as therapy to support better brain function and performance? (Literature)

How is the Biophilia theory applied to Interior Design of the built environment? (Practice)

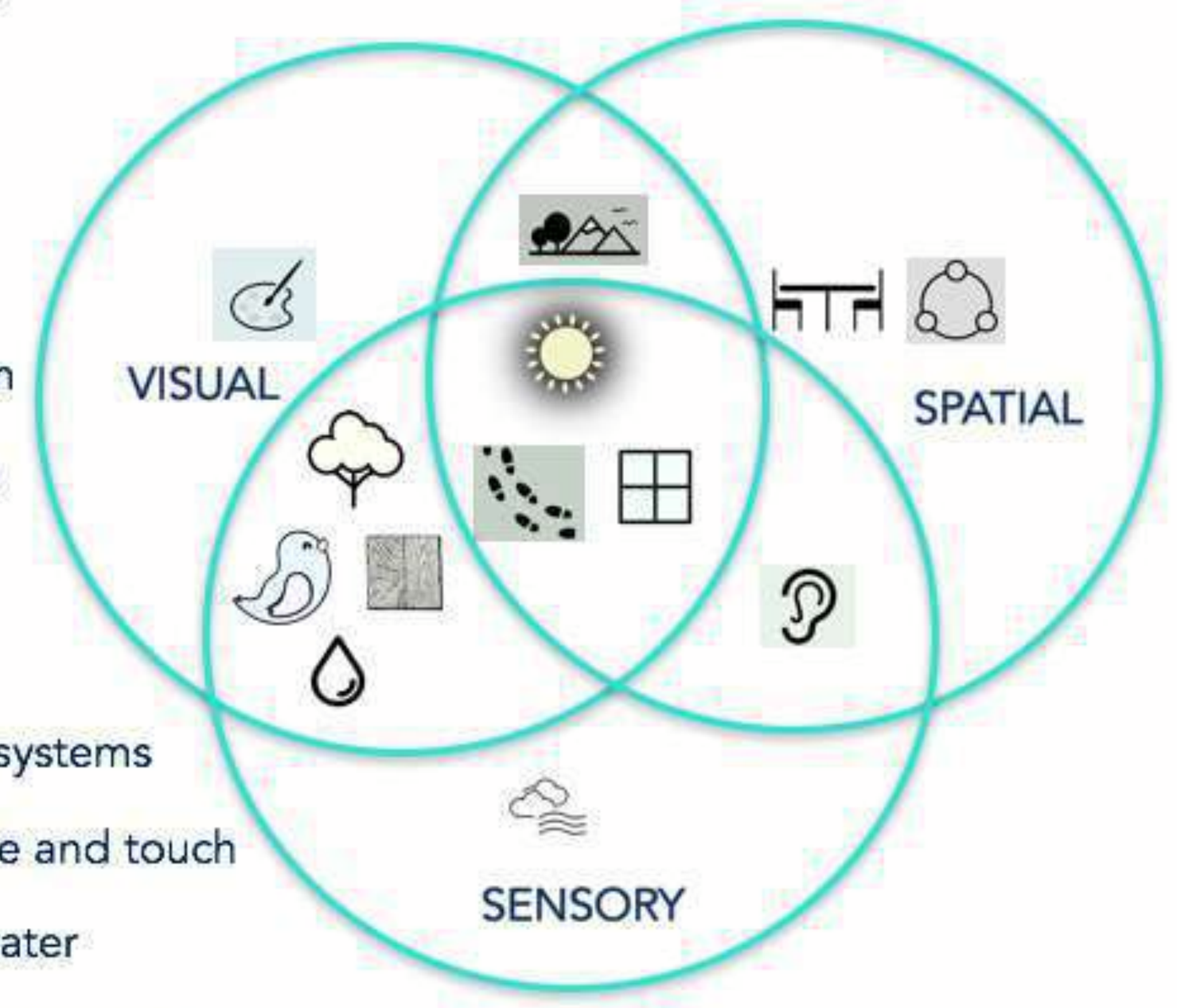
What do we know about the teenage brain that will help us design a better collaborative learning environment? (Neuroscience)

Literature map overview:

Environments for healthy neuro function	Biophilia	Learning environments for teenagers
Daylight and Circadian Regulation	Daylight and Circadian Regulation	
Executive Function/Movement		Executive Function/Movement
		Collaborative Learning
Restoration Theory	Restoration Theory	
14 Biophilia Patterns	14 Biophilia Patterns	

Design Patterns from Literature

- Soothing color palette
- Distance views
- Flexible Furniture
- Collaborative Spaces
- Windows in every room
- Daylight in every room
- Walking paths
- Views of nature
- Connection to natural systems
- Natural materials to see and touch
- Views and sounds of water
- Control of thermal environment
- Connection to auditory environment

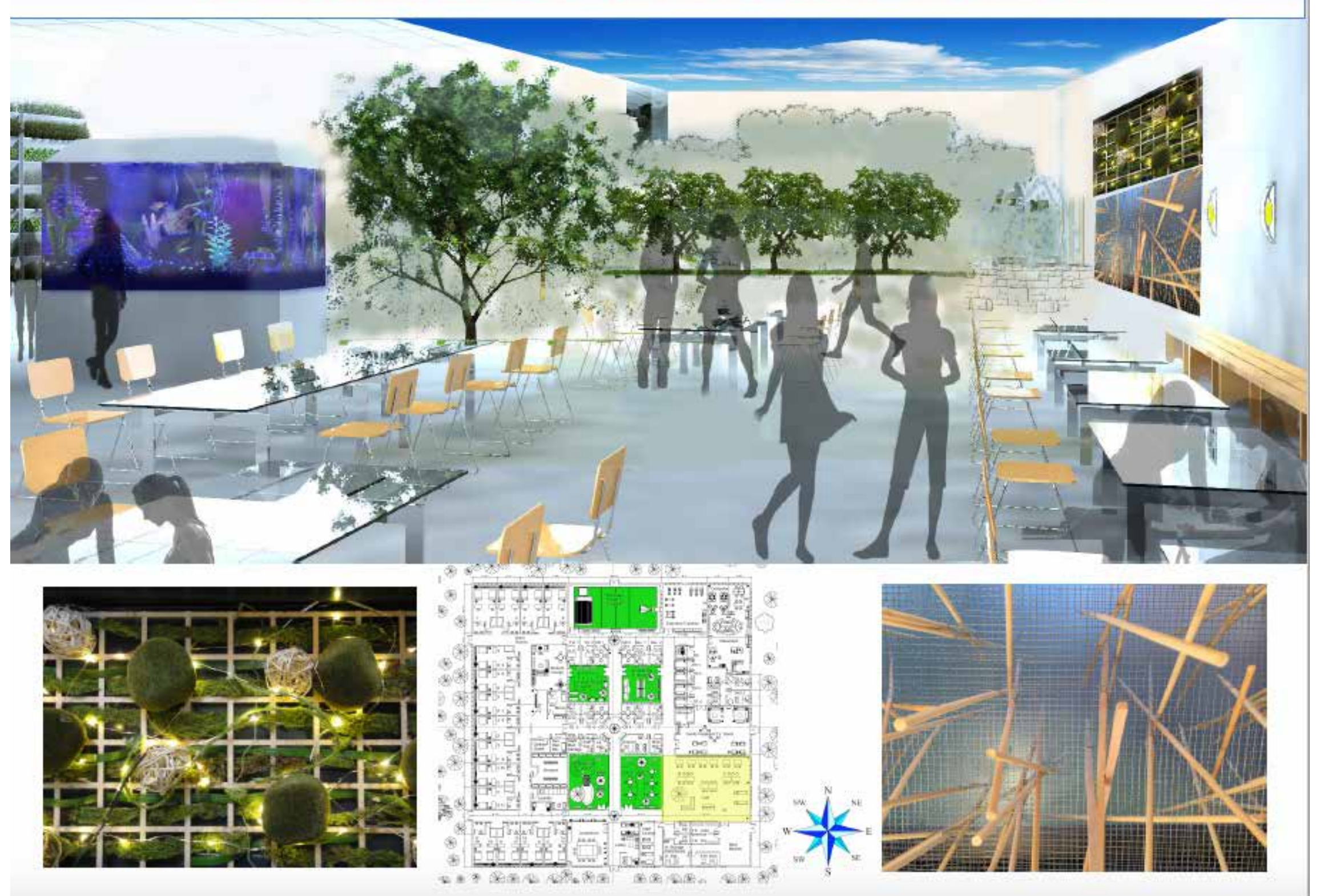


CASE STUDY SUMMARY: PATTERNS

All three of these schools incorporate views of nature, windows that provide natural daylight, a sensory connection to nature and walking paths for Executive Function. Patterns present in all three of the schools are collaborative learning, an auditory connection to nature, and a connection to nature through the other three senses. One of these schools has a connection to water, the use of natural materials and flexible furniture. None appear to incorporate a visual palette that embodies color for therapy. In summary, all these schools are strong in the patterns that have been identified as supporting biophilia and neuro-function. This suggests that in the international design community, the current Zeitgeist, or defining spirit and ideas of the time, is to incorporate nature into educational environments. Additionally, the findings help to verify the design patterns identified in this project as being appropriate for schools.

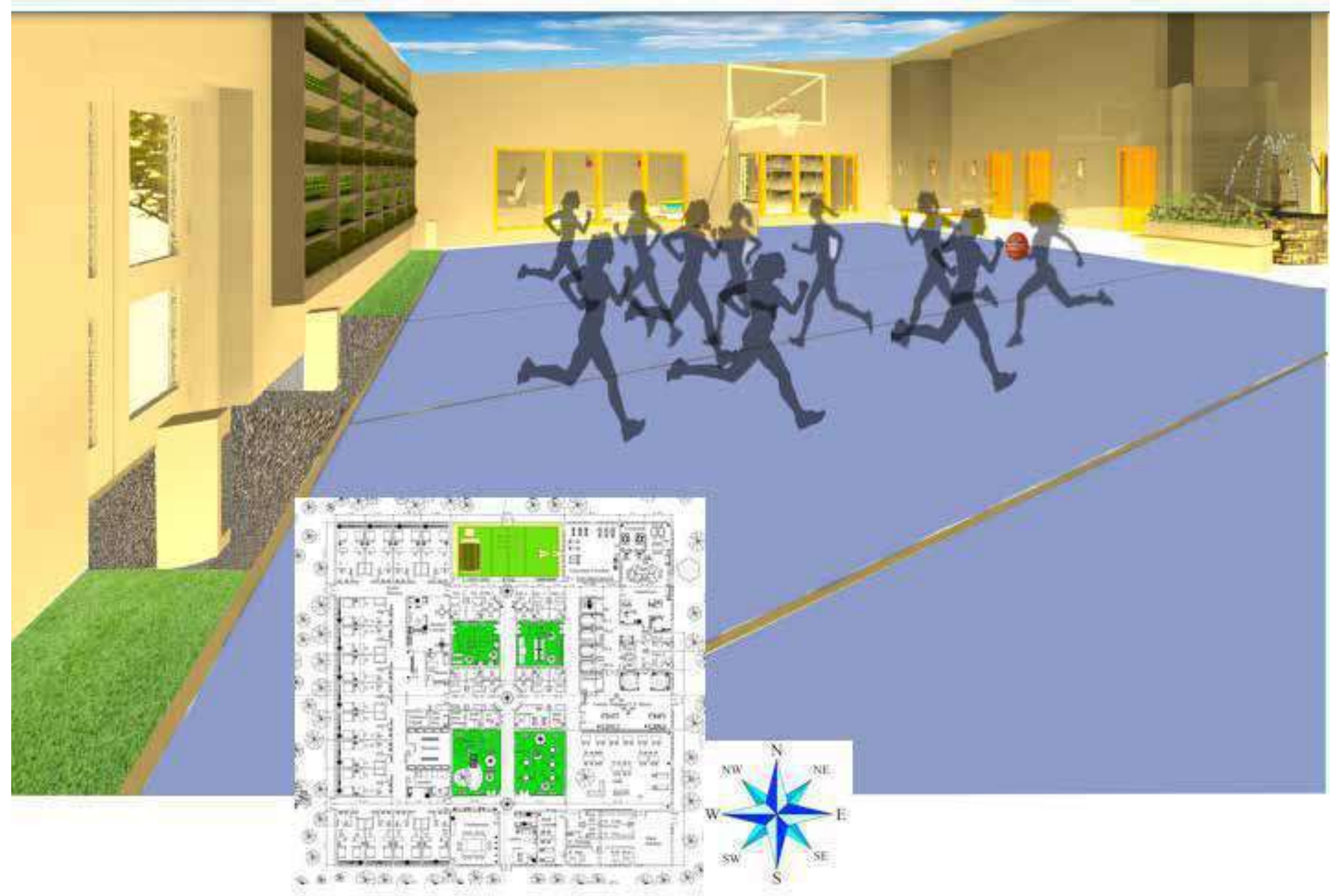
LOBBY VIEW WITH COURTYARDS IN REAR AND NATURE FILTERS AS ART

COLLABORATIVE AREAS: CAFÉ AND COURTYARD IN REAR



MAIN CLASSROOM VIEW LOOKING INTO COMPUTER AND ART CLASSROOMS

VIEW OF EXECUTIVE FUNCTION COURTYARD WITHIN THE DESIGN



STUDENT PRIVATE LOUNGE WITH NATURE ART FILTERS

DORM ROOM WITH VIEWS OF NATURE

THE DESIGN PROBLEM FOR REHABILITATION FACILITY

To create a model for a therapeutic, collaborative learning environment for teenagers that incorporates biophilia and neuroscience research, encouraging learning and well-being.

Overall Goals/Design Guidelines:

The facility will allow the inhabitants to **immerse themselves in** nature for health and well being with window **views** in every room for regulation of **circadian rhythms** and hormones, and a connection to the four seasons. *(Theoretical justification: biophilia/restoration/neuro-function.)*

The facility will **advocate improved neuro-function through** opportunities for executive function through **walking paths** and a **courtyard** typology. *(Theoretical justification: neuro connection to executive function.)*

The facility will be designed with a **therapeutic** climate providing ample daylight. *(Theoretical justification: biophilia/restoration/neuro-function.)*

The facility will incorporate the calming effects of **the** colors **of nature**. Focus is on green, blue, turquoise and violet. *(restoration/biophilia/neuro-function.)*

Visual Design

1. The design will use biomorphic patterns and colors of nature, both circular and organic in shape and form, and natural materials.
2. The views incorporated into the design will address prospect/refuge, and include views of nature and sky.
3. Walking paths both inside and outside will address executive function.
4. Flexible furniture will be specified for a multitude of learning environments.
5. The use of natural materials will be employed.
6. The learning spaces will provide controlled daylight, bright eastern facing classroom spaces, filtered light for circadian stimulation and windows in every room for visual pleasure with appropriate controls for glare.

Spatial Design

1. Opportunities for Executive Function/movement within the space inside and outside will be provided with walking paths.
2. An indoor/outdoor connection with natural systems will be provided through large windows and a courtyard typology, which will also allow for a connection to and an awareness of nature and its seasonal changes, access to natural light and outdoor learning spaces.
3. Spatial flexibility in the design of the interiors with furniture that offers Informal Design: a variety of areas to withdraw from activity as well as to collaborate.
4. Allow for Prospect/Refuge views within the design for comfort and safety.
5. Complexity and Order. Provide partially obscured views.

Sensory Design

1. Materiality used will be indigenous within nature.
2. Environmental conditions/controls will be employed: acoustic, thermal, luminous lighting properties.
3. Stochastic and ephemeral connections with nature, living systems or natural processes will be incorporated through a courtyard typology.
4. Haptic, auditory and olfactory sensory stimuli will be addressed within the design to regulate sound and smell.
5. The healing aspect of water will be incorporated into the design.
6. Sunlight on skin provides Vitamin D. Have plenty of windows and outside thermal experiences.
7. Fresh air for circulation to control unwanted odors.

Abstract

This research explores linkages between nature, neuroscience, and the built environment with the goal of developing a set of therapeutic design considerations that support teens within a rehabilitation facility. The literature review identified several key factors. First, exposure to daylight is important in regulating the circadian system. Second, physical movement ignites executive function processes that facilitate learning and behavior control. Third, the concept of biophilia – our affinity to nature – offers design principles that support restoration and general well-being. Findings from the literature are here developed into a framework that is specific to the design problem of a live-in facility for teen girls. The resulting conceptual design proposal demonstrates the importance of integrating nature, light, views, and opportunities for movement into a therapeutic living and learning environment.

BIOPHILIA: 14 BIOPHILIC PATTERNS

What?	Why?
Nature in the Space Patterns: 1. Visual Connection with Nature 2. Non-Visual Connection with Nature 3. Non-Rhythmic Sensory Stimuli 4. Thermal and Airflow Variability 5. Presence of Water 6. Dynamic and Diffuse Light 7. Connection with Natural Systems **Natural Analogues Patterns:** 8. Biomorphic Forms & Patterns 9. Material Connection with Nature 10. Complexity & Order **Nature of the Space Patterns:** 11. Prospect 12. Refuge 13. Mystory 14. Risk/Peril	The 14 patterns of Biophilic design improve health and well being in the built environment. (Terrapin Bright Green, 2014) Prospect/Refuge. Certain environments feel secure and meet human psychological needs when there is the capacity to observe (prospect) without being seen (refuge). Spatial dimensions added to prospect are a love of complexity, exploration and opportunity. This may result intuitively in spaces where a designer seeks to control the manner in which open and bright spaces are framed spatially. (Dosen, A.S., Ostwald, M. J., 2013)

Contributed Posters #5
Saturday, September 22nd | 10:30 – 11:30 PM

Sally Augustin & Susanne Siepl-Coates, Design with Science & Kansas State University/ La Grange Park, Illinois & Manhattan, Kansas
Applying Neuroscience Research to Boost Creativity

Meredith Banasiak, Boulder Associates Architects / Boulder, Denver
Supporting recovery through design: a translational application of the neuroscience of eating disorders to a treatment facility

Nadia Rachel, Nadia Rachel Psychology / Dublin
Effects and Influence of Entrance and Lobby Design on the Care of Mental Health Clients

Madlen Simon & Sabrina Nagel, University of Maryland / College Park, Maryland
A New Shelter Typology Fostering Mutual Child/Animal Rehabilitation: The Neuroscientific Connection

Laura Cambra-Rufino, Predoctoral Researcher at Universidad Politécnica de Madrid, Spain / Madrid, Spain
Analyzing Users' Experience of an Intensive Care Unit (ICU)

Lateef A. Lawal, Victoria University of Wellington / New Zealand
Design factors related to postpartum environments: Preferences for sense-sensitive spaces

Nastaran Shishegar, University of Illinois at Urbana-Champaign / Champaign County, Illinois
The Promise of Lighting for Improving the Quality of Life in Older Adults

Alexandra Mesias & Bob Condia, Kansas State University / Manhattan, Kansas
Assessing Architecture Students' in the Moment Creativity

Eve Edelstein, Perkins+Will / San Francisco, California
Clinicians for Design: Convergence of Expertise for Care

Deborah Wingler, Clemson University / Clemson, South Carolina
More than Feelings: Examining Child and Parent Affective Responses to the Ambulatory Surgical Process

Saeid Habibi, Polytechnic University of Catalunya (UPC) / Barcelona, Spain
Microbiome's Effect on Architecture and Architecture's Effect on the Microbiome

Bijal Mehta, UCLA School of Medicine, Los Angeles Biomedical Institute / Los Angeles, California
Microbiome's Effect on Architecture and Architecture's Effect on the Microbiome

Pegah Mathur, College of Design, North Carolina State University / Raleigh, North Carolina
Experimental Design for Evaluating the Effect of Lighting Interventions on Patient's With Alzheimer's: A Review

Supporting Eating Disorder Recovery Through Design

A TRANSLATIONAL APPLICATION OF NEUROSCIENCE EVIDENCE TO THE DESIGN OF A TREATMENT FACILITY

Meredith Banasiak, EDAC, Assoc. AIA | Design Researcher | *Boulder Associates Architects*
Mark Blaser, AIA | Associate | *Boulder Associates Architects*
Kathleen Reeves, MS, LPC | Vice President of Operations and Development | *Eating Recovery Center*

Background

Eating disorders (ED) are unique from other behavioral health classifications. Eating disorders overall have the highest mortality rate of any psychiatric illness. Anorexia Nervosa (AN) is the most fatal behavioral health disorder with the highest mortality rate, 10%.[ii]

Project Aim

Research has begun to unravel neural correlates of eating disorders (ED). Findings suggest functional and anatomical differences in processing and anatomy resulting in perceptual distinctions—many of which have environmental correlates in how persons with EDs experience their surroundings. Understanding this unique experience can inform the design of facilities programmed for treating EDs.

PART 1 — **Review evidence to identify neural and environmental correlates associated with EDs**

PART 2 — **Share results from studies conducted with patients about their experience in an ED treatment setting**

PART 3 — **Describe how evidence was applied to the design of a residential Eating Recovery Center in Denver, Colorado**

PART 1 Neural & Environmental Correlates of Eating Disorders

What are the neural and environmental correlates of eating disorders?
How do eating disorders impact a person's experience of his or her surroundings?

Environmental Correlates	Key Findings	Neural & Physiological Correlates	Patient Type
Sensory Information			
• Sensory Stimuli • Tactile cues including elements activating sensiomotor feedback such as textured walking paths, tactile surfaces.	• Sensory over-responsiveness, particularly somatosensory tactile. • Sensory modulation and related proprioceptive impairments affect spatial cognition.	• Altered serotonin function • Elevated stress system arousal from excessive noradrenaline and sympathetic activity.	AN Source: iii
Spatial Cognition, Orientation & Boundary Detection			
• Space Connectivity • Threshold Conditions • Gravitational Cues • Spatial Boundaries • Interpersonal Distance • Number and placement of physical elements including furniture and partitions contributing to a sense of crowding	• Patients with Anorexia Nervosa and Bulimia Nervosa over-estimate their body size. This overestimation impacts perception of the body's distance-distance relationship with other physical objects, people and the physical environment. • Shape and weight overvaluation may reflect a broader impairment in multisensory body integration. A coherent representation of body requires integration of perceptive sensory inputs including proprioceptive, tactile/haptic, visual and interoceptive, and multimodal. • Spatial orientation constancy is the central nervous system's ability to maintain the gravitational sense of verticality despite inclination of the body and/or the visual reference frame. • Less accurate spatial orientation awareness	• Processes (working memory), neurotransmitters (serotonin) and brain areas related to multisensory integration (frontal and parietal lobes), specifically: • **Proprioceptive:** posterior parietal areas related to egocentric spatial reference frame involved in spatial cognition. Parietal cortex metabolism significantly lower in bulimic patients associated with processing of proprioceptive information and in body representation. • **Tactile/haptic:** right parietal lobe, capacity in processing perceptions and somatosensory integrations. • **Multimodal:** areas related to multisensory integration and space representation in right temporo-parietal cortex, and right superior parietal lobule crucial for establishing a coherent body schema.	AN B Source: iv, v, vi, vii, viii, ix, x, xi
Formal Order			
• Formal order of building, rooms and furniture • Symmetry	• In a functional imaging study, patient participants experienced increased anxiety when viewing messy/chaotic/uneven environments versus ordered environments. Results suggest a higher concern for order and symmetry in ED than healthy controls.	• Structural abnormalities in right parietal lobe associated with the severity of ordering symptoms	AN Source: xii
Light			
• Natural Light • Tunable Dynamic Light • Light Intensity	• Light and food/eating are synchronizers of circadian rhythms. In eating disorders, the circadian rhythms of food intake are abnormal. Light and regular eating can synchronize circadian rhythms influencing hunger. • Brightness triggers more controlled and reflective forms of self-regulation and facilitates the suppression of desires and undesirable impulses. Exposure to dim/evening lighting promotes behavioral disinhibition undermining self-regulatory control, such as disinhibited eating. • Bright Light Therapy could be an effective non-pharmacological treatment of depression in AN. Findings indicate improvement of depressive symptoms (10,000 lux, 30 min daily).	• Serotonin plays a key role in the regulation of the light entrained oscillator located in the hypothalamic suprachiasmatic nuclei and the food entrained oscillator. • Prefrontal cortex regions associated with executive functioning tasks such as inhibition and self-regulation	AN B Source: xiii, xiv, xv, xvi

PART 2 Experience-based Data Collection, ERC Patients

Ethics Statement: In discussions between ERC Research staff and Sterling IRB specialists, it was determined that the study did not meet the criteria for human subjects under DHHS guidelines, so no submission for exemption review was made.

Given the limited evidence specifically examining interactions between the environment and eating disorders, mining the patient perspective was essential to developing hypotheses around environmental impacts on delivery of care and recovery. Because functional aspects of eating disorders tend to heighten a patient's dissatisfaction and ambivalence[xvii], conventional instruments such as patient satisfaction questionnaires do not accurately assess the experience of persons with eating disorders nor the success of the facility design in supporting recovery. That is, patient satisfaction in this population is not an accurate measure of patient experience.

Methods

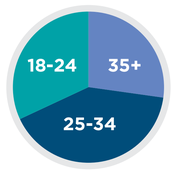
Data collection was structured as an exploratory study to uncover themes correlating patient values and outcomes with environmental attributes and spaces found in ERC facilities.

Participants

Past or current ERC patients who received treatment from one or more of three ERC facilities in the Denver region (n= 155) were invited to participate in an online survey.

Age of Participants

18 – 24 Years: **32%** 25 – 34 Years: **41%** Over 35 Years: **27%**



Environmental Qualities Associated With Healing

Patient participants were asked to rank (1st, 2nd and 3rd) the types of environmental features, in general, they find to be most healing among this industry-practice list: spaces to interact with others, familiar homelike qualities, bright colors, spaciousness, music, plants and nature, sunlight, fireplace, other.

The top three weighted responses include:

62% selected sunlight as either a 1st, 2nd or 3rd ranked environmental feature.
29% selected this as their first-choice feature.

56% selected familiar and homelike qualities as either a 1st, 2nd or 3rd ranked environmental feature.
24% selected this as their first-choice feature.

43% selected plants and nature as either a 1st, 2nd or 3rd ranked environmental feature their first-choice feature.
14% selected this as their first-choice feature.

The lowest weighted response was bright colors.
Only **5%** selected this as either a 1st, 2nd or 3rd ranked environmental feature.

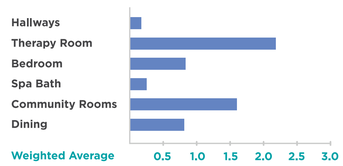
ERC Space Associations With Dimensions of Care

Patient participants were asked to identify which of six ERC space types (Dining, Community Rooms, Hallways, Bedroom, Therapy room, Spa bathroom) they most associated with overall recovery as well as the following specific dimensions: sense of healing, relaxation, social connection, sense of safety, control, independence in making choices, and stress.


Hallways | Group/Therapist Rooms | Bedroom

Facility Overall

The physical environment which most supported **overall recovery** at ERC was the therapy rooms followed by community rooms (n = 139).



The top three spaces ranked as needing the most improvement are:

#1 Community Rooms
#2 Dining
#3 Spa Bath

Stress Dimension

Nearly 60% (n = 140) reported feeling the most challenged in the Dining area.

In Which Space Do You Feel Most Challenged, In A Stressful Way?

Dining **59%**
Spa Bath **16%**
Group/Therapist Rooms **11%**
Common Areas/Community Rooms **6%**
Hallways **5%**
Bedroom **4%**

When asked in an open-ended question about physical features in dining which contribute to a sense of stress or challenge, tight spatial attributes such as "cramped" and "crowded" were mentioned by nearly 25% of respondents who provided comments (n = 82).

PART 3 Translational Application of Evidence to Environment

Based on evidence mined from the literature (Part 1), and ERC patient experience data (Part 2), we developed design strategies to support ED patient outcomes. A sample of such design interventions are illustrated in the following ERC spaces.

Dining Room (Serves Meals and Snacks Throughout the Day)

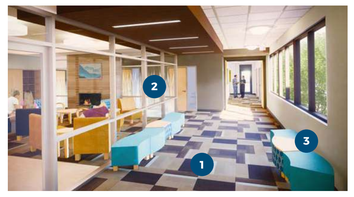
1. Access to Daylight: Based on the importance of light for persons with dysregulated circadian rhythms, and the strong association of sunlight with recovery suggested in patient survey results, the dining space was sited along the building perimeter to maximize access to morning and afternoon light through south facing windows.

2. Comfortable Proxemics: Given the evidence supporting altered body-space perceptions for ED patients, and patient experience reports of feeling crowded or cramped, a single dining room was demised into two dining areas, and the spacing between chairs was increased to 1.75 times the distance of chairs in typical dining areas. Views to the exterior aimed to support a greater sense of spaciousness.

3. Noise Control: Acoustic baffles were implemented to reduce reported stress associated with noise for ED patients with a high sensitivity to sensory stimuli such as sound level.

Community Rooms & Common Areas (Provide Space for Art Therapy Sessions and Social Interaction)

1. Spatial Orientation at Threshold Conditions: To support spatial cognition, the glazed wall separating the community room from the corridor helps orient patients as they navigate between these spaces. The wider corridor at this potential turning point supports an ED patient's altered sense of proxemics and aims to mitigate a sense of compression by expanding the sense of person-boundary distance.



2. Access to Daylight: Given long average length of stays, consistent natural light exposure throughout the day is important for supporting circadian health in ED patients. The glazed wall of the community room was designed to maximize light access, and an adjacent outdoor seating area provides an opportunity for outdoor community activities. This glazing also supports greater visibility of patients by staff eliminating a need for staff to physically enter, or invade, a space to check on patients.

3. Places to Pause: Corridor seating was implemented to provide another activity option in response to patient survey results suggesting that corridors are used by patients as hang-out spaces for social interaction and greater connection to staff. Moreover, it provides a resting point for weak patients traversing the corridor and to potentially reduce falls. The diverse shapes and textures among seating options provide choices for a wider range of multimodal sensory preferences.

Future Work

Limitations: This is the first known study to understand ED patient responses to, and perceptions of, environmental correlates. As such, it is exploratory work only beginning to identify potential areas for focused study.

Proxemics and Stress Response: We hypothesize that the patient's reported feelings of crampedness and crowdedness are the result of spatial and sensory processing and functional differences impacting an ED patient's estimation of space, versus an emotional response to being under surveillance, particularly in the dining setting. We recommend future study test perceived distances when person-person and person-object distances are varied and correlations with stress in new dining, old dining, and residential kitchens offering countertop dining where patients are not face-to-face with another person.


Eating Recovery Center of Chicago designed by Boulder Associates Architects. Photo by Caleb Tkach, AIAP

Correlations Between Dimensions of Care, Facility Spaces and Art.: We are building upon our patient survey data which correlated dimensions of care with ERC facility spaces, to identify art themes matched with corresponding activity settings and arousal levels (calm versus stimulating).

Initial results suggest that images rated low in arousal (most calming) are correlated with highest preference ratings (strongly like). Such art themes will be recommended for spaces such as dining where calmness and low arousal aim to mitigate stress and fear responses.

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Acknowledgments: We are grateful for contributions to this project and study by Gina Livingston-Smith, Tim Boers, Melissa Bachmeyer, and Liz Anderson.

A NEW SHELTER TYPOLOGY FOSTERING MUTUAL CHILD/ANIMAL REHABILITATION

SABRINA NAGEL + MADLEN SIMON
UNIVERSITY OF MARYLAND

THE NEUROSCIENTIFIC CONNECTION

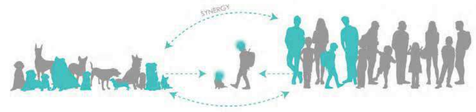
RESEARCH QUESTION

How can architecture facilitate the rehabilitation and mutual interaction of abandoned animals and troubled children?

THE PROBLEM

1.6 out of the 3.3 million dogs that enter animal shelters in the U.S. every year do not find homes (ASPCA)

11-20% of the 73 million children in the U.S. have a mental disorder (CDC)



METHODOLOGY

Literature Review - Precedent Study - Development of Design Principles - Application

Increase **OXYTOCIN** levels (Chandler)

Develop sense of **RESPONSIBILITY** Strengthen **BOND** (McCardle)

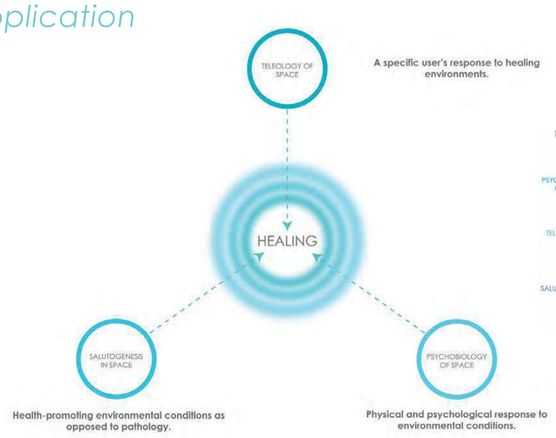
Improve **SOCIAL SKILLS** (McCardle)

NARROW
ARTIFICIAL
OPAQUE

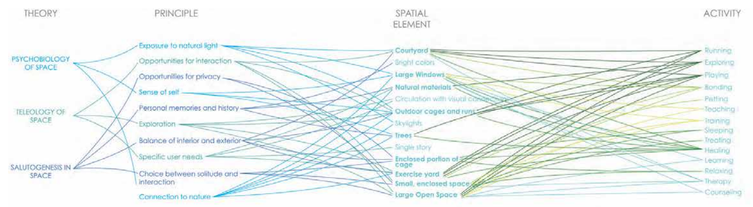
OPEN
NATURAL
TRANSPARENT

INTERACTION **ENVIRONMENT** **PRECEDENT STUDY**

THEORIES



(Nickl-Weller, Nickl)

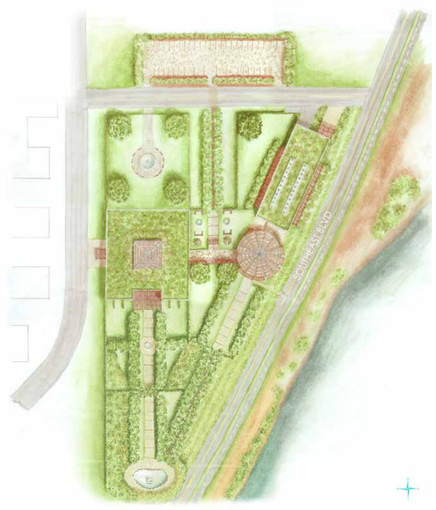


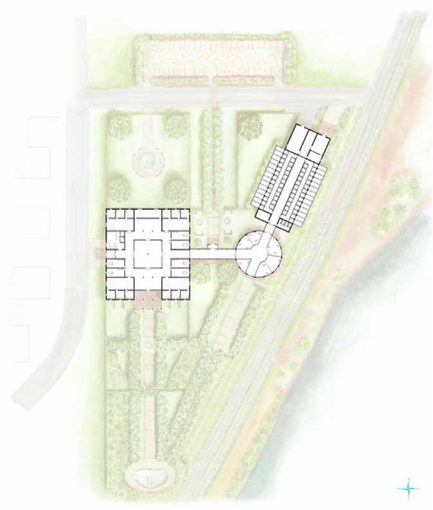
THEORIES OF HEALING ENVIRONMENTS

APPLICATION: DESIGN PROPOSAL

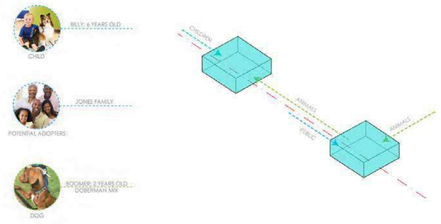
DIVERSE ENVIRONMENTS of Washington D.C.

Provision of **ANACOSTIA RIVER VIEWS** at Hill East

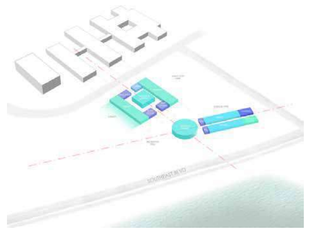




TELEOLOGY/ SALUTOGENESIS



User groups and respective spaces of **MEETING**



Programmatic arrangement and articulation of **OUTDOOR** spaces

PSYCHOBIOLOGY

Courtyard:
Large, open space / Natural light

CHILDREN ⇄ DOGS

Threshold:
Balance between indoor and outdoor/ Connection to nature

Oasis:
Tree Cover/ Large, open space

CHILDREN DOGS ⇄ ADOPTERS

Link:
Large windows / Natural Light / Connection to nature

Courtyard:
Large, open space / Natural Light

ADOPTERS ⇄ DOGS

Kennel:
Balance between interaction and solitude / Natural light

Dog Entry:
Connection to nature

CONCLUSIONS

How can we measure the effects of the therapeutic design on children and dogs?

We can utilize **NEUROSCIENTIFIC** tools in order to measure **ANXIETY** and **STRESS** levels in both children and dogs upon admittance to the facility as well as after engagement in therapeutic interaction.

An **EEG** has been proven to measure a spectrum of **ANXIETY DISORDERS** including PTSD, OCD, phobias, and generalized anxiety (Hammond). An EEG can also be used on canines, though standard behavioral examinations would provide calrification to results

How can neuroscientists and architects collaborate to understand the effects of the design itself?

A neuroscientist may be able to use tools such as an EEG to focus on moments directly following interaction in specific spaces. Both dogs and children may experience different reductions in stress levels in the courtyard meeting spaces, outdoor spaces, and more privatized therapy rooms.

Additionally, a simple questioning of a child's favorite space would allow both the architect and neuroscientist to evaluate the specific qualities and elements of that space.

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Analyzing Users' Experience of an Intensive Care Unit ICU

1 Abstract

The aim of this abstract is to share the research work on the environmental conditions (both quantitative and qualitative) in an ICU of an acute hospital.

This project is a small part of a Ph.D. thesis in progress at Escuela Técnica Superior de Arquitectura de Madrid (Universidad Politécnica de Madrid, Spain) funded by "Ayudas para la formación de profesorado universitario FPU, Ministerio de Educación Cultura y Deporte de España".

The method used for analyzing users´ experience consisted of a three-month placement at Hospital Marina Salud de Dénia (Alicante, Spain) sponsored by "Beca DKV Arte y Salud". During that time, we used a three-step ethnographic strategy:

- Firstly, we studied and observed users' behavior in the ICU environment.
- Secondly, we carried out walking interviews to members of staff (nurses and anesthesiologists), patients and companions. In these interviews we asked them for their everyday routines and took notes about their comments on the interaction between their activities and the built environment.
- Thirdly, we drew users' flow on the ICU plan and wrote down the conclusions about their functional and emotional needs.

The overall purpose of this analysis was to identify and enlist specific users´ requirements that should be considered on the design process of an intensive care unit.

2 Figures

Users´comments on their functional and emotional needs.

Interviewed users: patients and companions.
Written informed consent.




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Design factors related to postpartum environments: Preferences for sense-sensitive spaces

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ABSTRACT

Background
Research suggests that the hospital postpartum environment is busy, noisy, and not therapeutic. It does little to promote rest, healing, and recovering, including learning parental skills for new mothers after the childbirth. Physiologically and emotionally, women often face the challenges of how to cope with fatigue and exhaustion within that vulnerable and private moment. Since the built environment is an adjunct of these numerous challenges, it is possible that neuro-architecture particularly a designed sense-sensitive space may benefit women's recovery process. Importantly, this set of users are well people and are different from the usual unwell in-patients receiving treatments in a care environment in different areas of the hospital. The increased trend in patient-centered healing architecture suggests great opportunity for architects and researchers in healthcare domains to employ both users' experiences and perception of the spaces in evidence-based design. To date no studies have explicitly considered the study of restorative elements for the postpartum hospital environment for women.

Purpose
The gap that this research ultimately aims to fill is focused on deriving appropriate restorative environments for postpartum recovery in large tertiary hospitals, where there is already clear evidence that the physical environment is unsupportive of recovery in spite of the increasingly greater use women make of large tertiary hospitals for childbirth.

Methodology
Women and midwives, participated in online questionnaire surveys to determine the specific physical restorative factors for postpartum spaces in New Zealand hospitals. 229 postpartum women who gave birth in October 2006 and November 2017 and 58 midwives who have worked or are still working in the postpartum ward/environment participated in the survey.

Findings
This preliminary study found particular designs and sense-sensitive spaces may potentially benefit the making of a holistic restorative place for women after childbirth.

Conclusions
The findings presented are part of on-going work which could assist healthcare facilities designers develop evidence-based design framework/guidelines for a restorative hospital postpartum environment by understanding the specific role of spaces and design elements, and their impact on women's physical restoration and wellbeing after childbirth.

Keywords: Postpartum environment, recovery, sense-sensitive space

Introduction

In past decades maternity units were at the forefront of therapeutic healing environments manifested in the design of alternative birthing centres as a response to a consumer-led movement for a more "home-like" environment that allowed control (Stichler, 2007; Verderber, 2010). Despite design improvements following trends in person-centred care in hospital settings and birthing environments in recent times, particularly in the labour and delivery suites, little research has been carried out on aspects of postpartum room designs in hospitals.

Therefore, how to create a healing or therapeutic environment for healthy women who go into the hospitals to have babies remains an important question that needs to be addressed as increasingly more women give birth in hospitals and spend time there for the postpartum period. Limited information exists about the key elements for a restorative hospital postpartum environment for women having their stay after childbirth.
This study is aimed at contributing information to understand the physical design factors of the postpartum environment that have potential to assist in creating restorative settings for a woman's physical, physiological, and psychological wellbeing during hospitalisation.

Research methodology

In developing sense-sensitive spaces for the postpartum environment, this study found a survey an ideal strategy to use, especially in an environment where there are restrictions of access and importantly, because women spend little time in the postpartum environment.

Participants were 229 postpartum women and 58 midwives. The participants had either used the postpartum spaces up to about two years previously (July 2016 to Nov 2017) following the birth of their child, or have worked in the postpartum wards as midwives.

Procedures

The survey had several categories, which addressed aspects of the physical environments comprising the perception of the physical space/room, interior features, sensory comfort, safety and security, and social comfort. The sensory comfort aspects were visual comfort, thermal comfort and acoustic comfort including comfort related to choice of room types.
This paper reports only the findings about the interiors and sensory comfort. These two aspects could possibly suggest the feelings and experiences of postpartum women in terms of interior environments where they recover after the birth. They are also crucial to understanding behaviours, emotions, and sensory interactions within the physical environments and their affordances, thus providing an engagement of human experience and the designed environment to be understood using neuroscience (Banasiak, 2012).

Results and Discussions

Interior features, recovery and wellbeing

Women and midwives were asked to rate how important they think it is to have these three aspects: "a restful room", "a room that daylight can easily enter" and" a room where door is closed for privacy" during the postpartum recovery phase.
Women (N=198) agreed that there was an association of recovery with a restful room M =4.88 (SD = 0.38). By comparison, midwives (N =48) opinion was also associated with the value of a restful room M =4.77(SD = 0.52). A similar association was found with daylighting across both groups women, M =4.50 (SD=0.62), and midwives M =4.52 (SD=0.58) respectively. The exception is privacy, where opinion differs considerably between women and midwives, meaning that there was a statistically significant difference between women and midwives, Privacy: t (244) = 3.30, p < .001

Sensory comfort

Women and midwives were asked how comfort-related indoor climate features such as room temperature, sound, and air quality among others influence postpartum recovery and wellbeing.
Only three of the findings from this category are discussed. These are :"a hygienic clean environment", "Air quality and room freshness" and "noise control" as these are critical for maintaining sensory stimulation on the postpartum ward.
Differences among the means were further tested using an independent samples t-test.
Air quality and room freshness: Equal variances assumed t (241) = 0.44, p =0.660; Hygiene/clean postpartum environment, t (241) = 0.26, p =0.796 and Noise control: t (241) = 3.88, p <.001

Means and Standard Deviations of Preference Ratings for Interior Features

	Women		Midwives		
Category	Mean	SD	Mean	SD	*P*
Interior features					
A restful room is important to my birth recovery	4.88	0.38	4.77	0.52	.158
Appreciate a room daylighting can enter	4.50	0.62	4.52	0.58	.796
Be in a room where the door is closed for privacy	4.46	0.85	4. 00	0.97	.001

Means and Standard Deviations of Preference Ratings for Sensory Comfort Features

	Women		Midwives		
Category	Mean	SD	Mean	SD	*P*
Sensory comfort					
Air quality and room freshness	4.72	0.53	4.68	0.59	.660
Hygiene/clean environment	4.91	0.34	4.89	0.38	.796
Noise control from equipment	4.06	1.03	4.66	0.48	.001

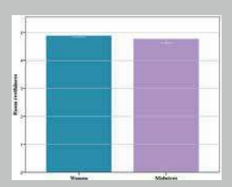
Figure 1 Room Restfulness (with 95% Cls)


Figure 2 Natural daylighting (with 95% *CIs)*

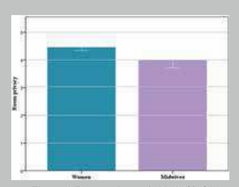
Figure 3 Room privacy (with 95% *CIs)*

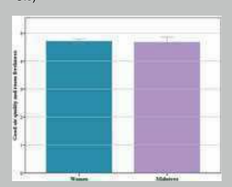
Figure 1 Air quality and room freshness

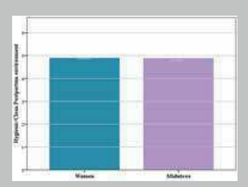
Figure 5 Hygiene/clean environment

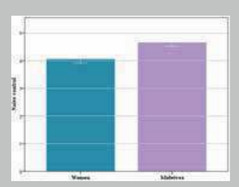
Figure 6 Noise control

Implications for Design and Neuroscience

Mostly recovery care would take place in the interior environment of the postpartum space. Creating an indoor environment in which women and their caregivers can feel comfortable is vital in the postpartum environment. Moreover, daylighting admission into the interiors underscores the basis of research linking architecture and neuroscience to the environmental impacts on premature infants, to enhance development of the premature infant and reduce interference with their neuronal systems and as an architectural response for jaundice treatment.
Having a noise-free environment is linked to ability of a place to mediate and restore to vitality. There is a need to develop sustainable design strategies aimed at addressing the noisiness and unrestful situation of the environment. The postpartum environments require an evidence-based design solution towards a wholistic improvement.

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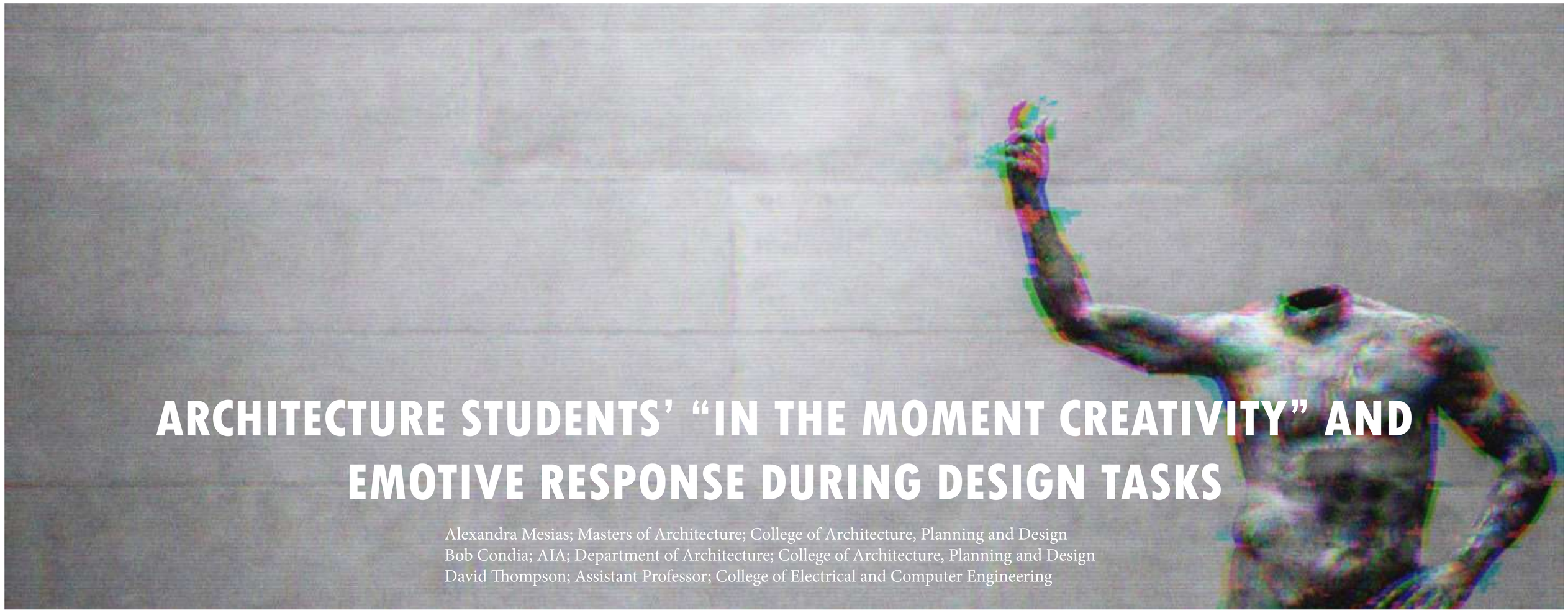
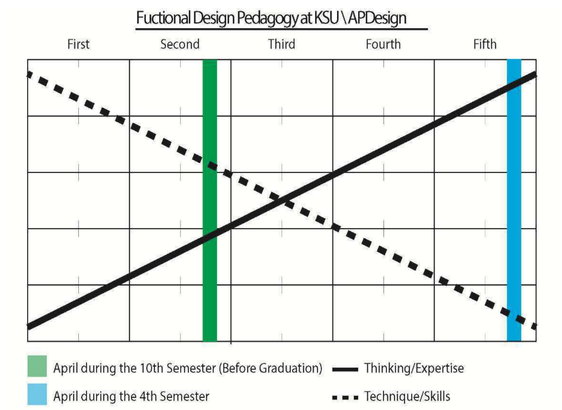
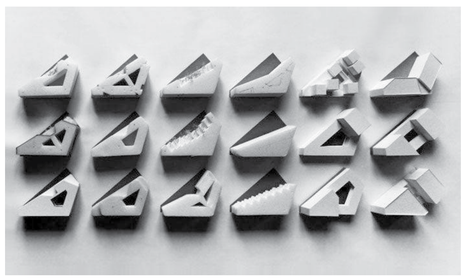


ARCHITECTURE STUDENTS' "IN THE MOMENT CREATIVITY" AND EMOTIVE RESPONSE DURING DESIGN TASKS

Alexandra Mesias; Masters of Architecture; College of Architecture, Planning and Design
Bob Condia; AIA; Department of Architecture; College of Architecture, Planning and Design
David Thompson; Assistant Professor; College of Electrical and Computer Engineering



This diagram demonstrates the basic pedagogical framework of architectural education at Kansas State University's Department of Architecture. Architecture as a profession is known as a practice. One learns Architectural design by doing. In analogy to other activities where body knowledge is fundamental. Young students of architecture must begin with the tools of their profession: drawing, building models and mastering software. In architectural education it is understood that skill development must come first, from first to fifth year, the Technique/Skills emphasis decreases as the students begin to master the basic talents of representation. The line of Thinking/Expertise is an ascending line recognizing that young students begin by learning the vocabulary of architecture.



For architects the foundation of design and creative enterprise is iteration. In professional practice iteration can be understood as the free play of alternative schema loosely based in variations of intentionality. The process of iteration circulates around a similar goal rather than following a linear path. A process that artificially attempts valueless. In architecture, iteration is the fundamental thinking of the design process. In this way iteration is better understood as a practice used to master the variables of an architectural problem similar to a musician mastering riffs to be later assembled into a composition. Unfortunately, and surprisingly so, there are little to no studies proving iteration as crucial to the creative process.

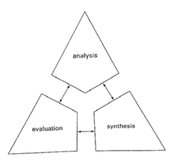


Figure 1.1

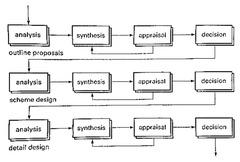
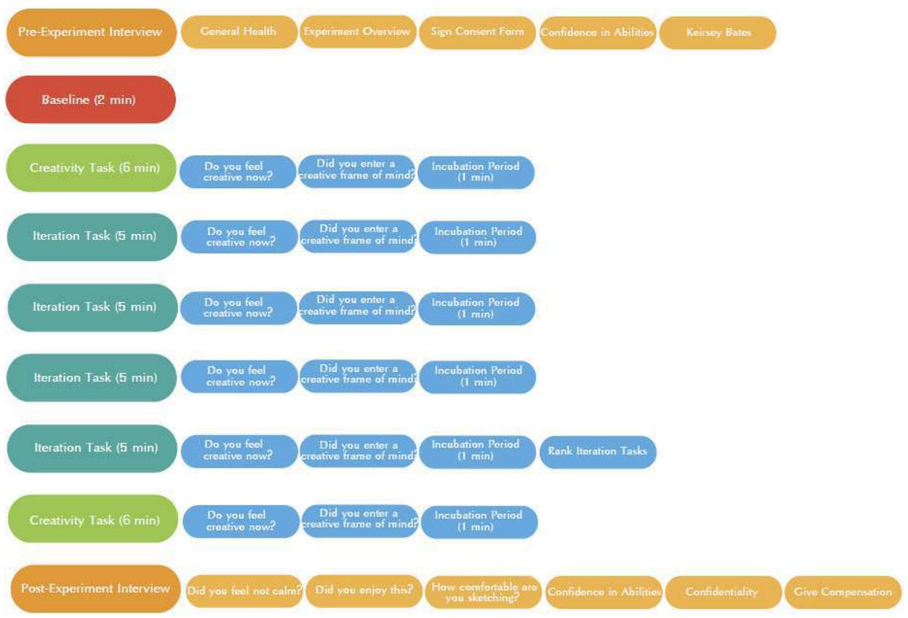


Figure 1.2

Figure 1.1:
Triangulating the three elements required for the design process- a more accurate representation of the relationship of iteration (ref. Lawson)
Figure 1.2:
The Markus/Maver design process map of iteration (Lawson).
Any artist must master the medium of their expression, both in a general mastery of the tools of the craft but in the practicing of the specific project. Iteration, so defined, is the basis of architectural studio in the education of Kansas State University's Architecture program. We found no precedents in experimental stimuli that met these criteria so we designed our own.

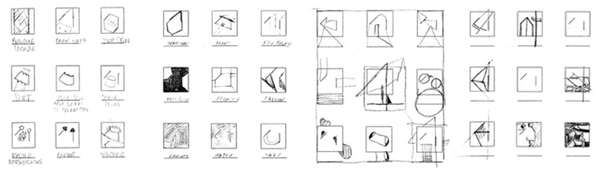
We report a new study of biological correlates of creativity in architectural design, which **tests the effect of experience in reaching a creative state**. Our study to build on an experiment conducted on 40 top architects (1958-9) by Berkeley's Institute of Personality Assessment and Research.2 Allied is the work of E. A. Carroll's "In the Moment Creativity" (ITMC), which proposes creative evaluation as a measurable biological response, in turn eliciting decreased arousal level during ITMC."3 Our experiment tests for **differences in arousal levels** of graduate students (in their last semester of education) versus sophomores (at the end of their first year of architectural education). Our hypothesis is that older students will more quickly enter ITMC, the designer's frame of mind, because of experience in a design curriculum.



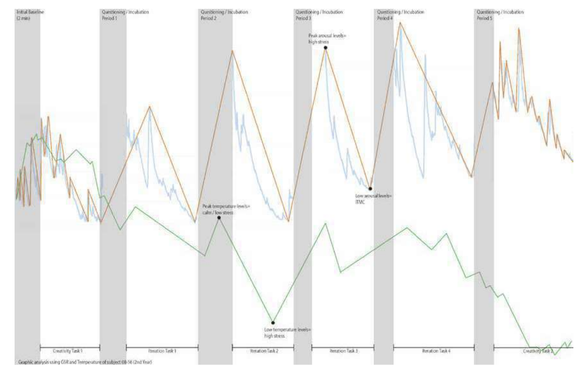
Our research purposes aim to test the changes in physiological arousal between the two groups of architecture students, with varying backgrounds in design and levels of creativity. To further emphasize, we are not concerned with how creative the student. The dual design tasks involve a series of iterative drawings and a creativity test based on the Architectural Aptitude Test used in Berkeley's study, similar to the modern Panamericana Creativity Test. Using BioGraph Infiniti equipment, subject's biological responses will be recorded.

Throughout the experiment, the 18 second-year and 20 fifth-year architecture students were attached three different biofeedback equipment: Galvanic Skin response, Temperature, and EMG. From the beginning, we were confident that GSR would be the most accurate tool. From these real-time results, we are able to pin-point when exactly the subject was most stressed and the pits when the subject was entering a calmer state.
Architectural education has two levels of arousal we hope to measure in developing designers: First, a general emotive response to the stress of being asked to be creative or solve a problem of form; Second, when doing so is there a legible emotive state that coincides with being creative? In the second case, we find the work of Carroll to be descriptive of an iterative frame of mind.
he experiment pushes the student to think in an iterative process by repeating the tasks labeled "Iteration Task" 4 times.

According to "The Creative Architect," confidence is telling to the designer's ability to be creative. So we asked the subject questions directly after each tasks to get real-time and accurate answers that targeted how they felt they performed during the tasks or if they felt like they entered a creative frame of mind. Never are we questioning their skills, only their physiology through the tasks. By incorporating both the biofeedback and the self-reporting methodologies, we are able to acquire a scientific basis (biofeedback) as well as an alternative method to support the science: self-reporting; a method proven to hold validity in experiments

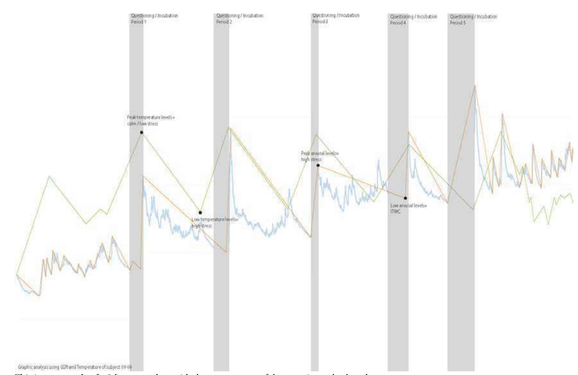


As the 4 iteration tasks were expected to mimic the design process, the creativity tasks are modeled in parallel to the studies from the 1958 experiment. This particular tasks acts as a warm up and cool down that bookend the 4 iteration tasks.



It was William James who first suggested the connection between bodily reactions and emotional experiences. The position of this research synthesizes a relationship between creativity and cortical arousal (Picard 1997).

In other words, high alpha-wave amplitude represents low cortical arousal. The link between cortical arousal and amplitude is described as the higher the amplitude, the lower the cortical arousal. Highly creative people are able to defocus and focus their attention instantaneously, meaning, because they are more creative, their brain does not have to stimulate high cortical arousal. On the other hand, those with lower levels of creativity, try harder during specific creativity tasks, so their arousal levels are higher (Martindale, 1999).
The data tells us that among second and fifth year students, a signature appears that suggests different rates and at which points during the experiment each subject enters "In the Moment Creativity." This is an example of a 2nd year student with the components of the experiment broken down.



This is an example of a 5th year student with the components of the experiment broken down.

Abstract
This experiment began as an exercise in the craft of collecting good data, albeit if looking at the aesthetic process in reverse. Our study seeks biological correlates of creativity in architectural design, testing the effect of maturity and confidence in reaching a creative frame of mind. We build on the Berkeley's Institute of Personality Assessment and Research experiments conducted on 40 top architects (1958-9)2 and on the work of E. A. Carroll's "In the Moment Creativity" (ITMC), which proposes creative evaluation as a measurable biological response, in turn eliciting decreased arousal level during ITMC."3 Our experiment tests for differences in arousal levels of graduate students versus sophomores. Our hypothesis is that older students will more quickly enter ITMC, the designer's frame of mind, because of experience in a design curriculum. In architectural education two arousal levels exist that we measured in our experiment One of them being A general emotive response to the stress of being asked to be creative or solve a problem of form. And the other question was when doing so is there a legible emotive state that coincides with being creative?

In April 2017, we tested eighteen second-year and twenty fifth-year architecture students. Participants first completed a Keirsey Bates Temperament Sorter which provides an alphabetical notation in sequence of Extrovert versus Introvert (E or I), Sensing versus Intuitive (S or N), Thinking versus Feeling (T or F), and Judging versus Perceiving (J or P), from which we noted correlations between personality types and the statistical results for thinking like an architect. We also asked them about their confidence levels in sketching with a pencil. We question their confidence in their abilities to create throughout the experiment to suggest the direct relationship between confidence and "thinking like an architect."2 The arousal stimulants were six design tasks in two forms: 1) the creativity test used in the Serraino's The Creative Architect, regarding itself as a warm up and cool down in relationship to 2) the iterative test utilizing a repetitive system that requires varied solutions to the same formal inquiry (figures la and lb). The iterative tests were (by necessity) of our own invention, as current science sees iteration as a problem to be solved rather than a fundamental method or craft. Architects use iteration to discover a problem. The four repetitions of the single task allow the subject to enhance their design skills upon each task until a desired result is achieved. We believe by the fourth iteration they will have felt at the height of their creative capabilities. Biological correlates were measured using a BioGraph Infiniti System's finger temperature-measuring sensor, Galvanic Skin Response (GSR), and Electromyography (EMG). During testing, at the end of each task, we asked the subjects for a self-assessment to gauge how creative they felt during that task. Based on these self-reports and the sensory recordings, we were able to compare when and at which task, the participant demonstrated "in the moment creativity."

Observations during experimentation bear out that arousal significantly reduces when subjects enter the focused frame of mind we associate with designing, especially evident in the INTP personality type (one who is an introvert, intuitive, a thinker, while also being perceptive suggesting a curious and ambitious attitude) from the temperaments. Preliminary inspection of the data shows qualitative differences between second and fifth year students, and between temperaments, which we think a generalized additive model and statistical analysis will display a signature or line of best fit for ITMC (figure 2). We are currently testing self-proclaimed 'non-creative persons' as a control group. We think we can suggest from our data that tutorial experience in design studios can produce quicker access into the creative frame of mind, although personality or temperament might be more important.

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APDESIGN

Clinicians for Design

A Convergence of Expertise to Enhance Cognition and Healthcare Design

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ABSTRACT

Background:

Increasingly, clinicians are asking not only for the architect's perspective, but to develop a design skill-set and knowledge-base that will allow them to help shape the future of hospitals, medicine, and healthcare.

Purpose/Objectives:

Clinicians for Design is an international network of clinicians and researchers with a vision to inspire and accelerate the design of environments that enhance health outcomes through innovations in healthcare spaces, technologies, care delivery systems and policies (1).

The inaugural Clinicians for Design workshop was hosted at the Royal College of Physicians, during the European Healthcare Design conference, London, UK in June, 2017. Thereafter, workshops and research activities with hospitals and academic medical centers are exploring key lessons learned from the clinicians, healthcare system leaders, and medical researchers. Specific objectives include the application of research to improve practice, meetings to increase clinician understanding of the architectural process, and integration of clinical expertise with design-thinking.

Methods/Results:

As 'neuro-architectural' research converges with clinically-informed design, it has inspired the emergence of new models of practice for dementia care. A network of like-minded clinicians, neuroscientists, and a team of geriatricians and designers have formed an alliance to enable a deeper understanding of the elements which contribute to dementia-inclusive design in healthcare facilities.

A leading cause of institutionalization for those with dementia is often spatial disorientation (2). Absence of cognitive mapping in dementia can be partially compensated for by using other forms of orientation strategies (3). Therefore, the design of healthcare facilities can significantly influence one's spatial orientation and wayfinding abilities (4). This grant-funded study aims to develop a 'Design Audit Tool' in line with Dementia-Inclusive Design Guidelines, ensuring equality across healthcare users (5). The goal is for inclusive, accessible, and easily understood environmental design for people with dementia, based on neurological and architectural research.

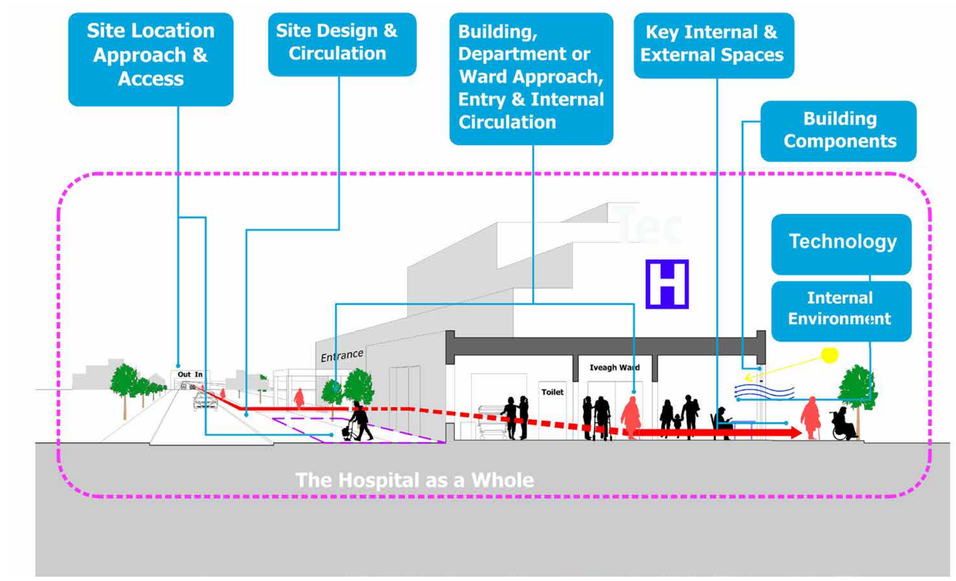
Implications:

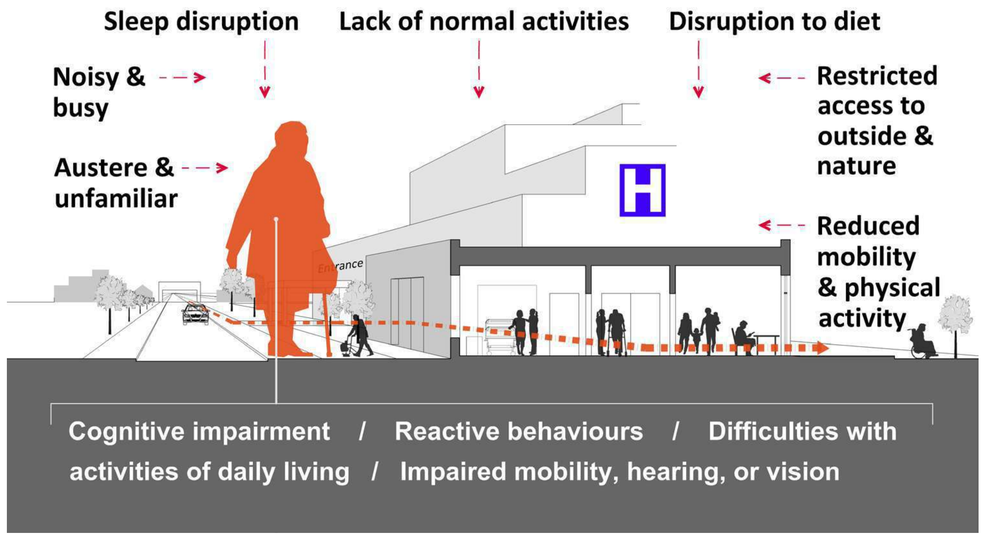
Clinicians and designers discuss their progress in identifying dementia care pathways and research outcomes using a transdisciplinary approach. The advances towards a dementia inclusive healthcare audit tool is described, including the role of experts and emerging professionals in medicine, research, and design who seek an enduring connection between clinical practice and architecture.

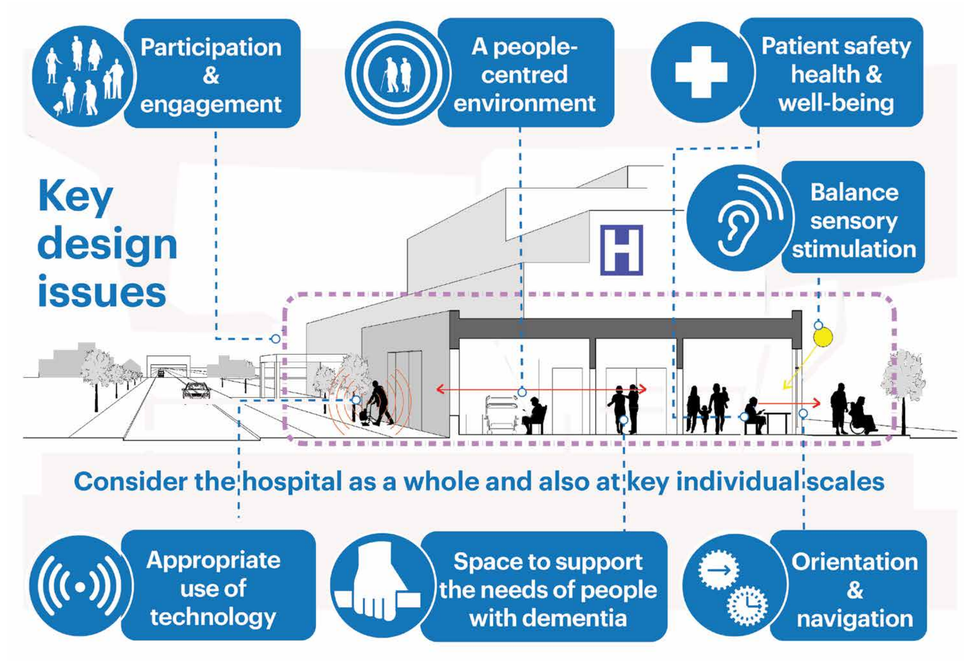
Development of a Dementia Friendly Hospital Audit Tool from a Universal Design Approach

The recent Irish publication of the Dementia Friendly Hospitals from a Universal Design Approach: Design Guidelines 2018 (Grey et al 2018), saw a development in dementia friendly design for healthcare building in a few ways. Firstly, the guidelines are underpinned by Universal Design along with key dementia-friendly design issues to ensure not only a supportive or prosthetic environment, but also an actively therapeutic and healthful setting. Secondly, they acknowledge the need to think about hospitals in their totality, rather than disconnected individual spaces. Thirdly, the guidelines emphasise the need to consider how the key internal and external public spaces of the hospital form a strong connective tissue or public realm as a major orientating device in the hospital. Finally, and most importantly they recognise the need for greater collaboration and design participation for all key stakeholders.

Following on from these guidelines a dementia-friendly design audit tool is now being developed to support the guidelines by evaluating existing buildings and proposed designs, and by promoting an inclusive and healthful environment for patients with dementia, accompanying persons, visitors and staff. In this regard the audit tool is being constructed around several core pillars as set out below.







Shaped by a holistic definition of Dementia Friendly Design, a universal design for a dementia friendly hospital should:

- Be accessible, understandable and easy to use for all occupants.
- Recognise the cognitive, behavioural and psychological, physical, and sensory difficulties that a person with dementia may experience as a patient or visitor to the hospital.
- Reduce hospital related environmental stress.
- Provide a prosthetic or enabling environment to account for dementia-related disability.
- Create a healthful and therapeutic setting to promote healing.
- Recognise that dementia friendly design, not only supports people with dementia, but also supports accompanying persons, visitors and staff in their caring role.

Informed by Universal Design

"Universal Design" includes the design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. "Universal Design" shall not exclude assistive devices for particular groups of persons with disabilities where this is needed." (Article 2 of the United Nations Convention on the Rights of Persons with Disabilities)

Adopting a Universal Design Approach recognises that a general acute hospital is a complex environment that must cater to a wide range of patients, visitors, and staff. These building users will have diverse abilities and needs, and represent people across the age spectrum, therefore a dementia-friendly approach underpinned by Universal Design is required, rather than a dementia specific approach.

Underpinned by Key Dementia Friendly Hospital Design Issues

Support Engagement and participation

1. Promote engagement with friends and family, staff and community.
2. Provide space and supports for accompanying persons.
3. Promote a participatory design approach.

Provide a people-centred environment

4. Soften the institutional environment.
5. Familiar or recognizable design that is easily understood and intuitive.
6. Facilitate personalisation and opportunities to add personal belongings.

Support patient safety and health

7. Provide a safe environment through unobtrusive safety measures.
8. Support diet, nutrition and hydration.
9. Support meaningful physical and social activities including ADLs.

Balance sensory stimulation

10. Optimise positive sensory stimulation and minimize negative stimulation.
11. Provide indoor and outdoor contact with nature, and access to the outdoors.

Support orientation and navigation

12. Support orientation to date, time, location, and improve spatial cognition.
13. Provide good way-finding to support navigation.
14. Provide good visibility and visual access.

Provide adequate space to support the needs of a person with dementia

15. Bays or single rooms with space for personal belongings and visitors.
16. Retreat spaces in multi-bed wards or communal areas in single-bed wards.
17. Provide space and supports for patient mobilisation and activities.

Provide appropriate use of technology

18. Appropriate use of technology for care delivery, safety, therapy, communication, and entertainment.

Create usable space for the hospital as a whole and at different spatial scales

- Site Location, Approach and Entry
- Campus Design and Site Circulation
- Approach Entry and Internal Circulation
- Key Internal and External Spaces
- Building Components
- Technology
- Internal Environment

Facilitate a collaborative / participatory process usable by experts and non-experts at different stages of the design process

For Example:

- Briefing process
- Sketch or Concept Design
- Developed Design
- Planning or Development Permission
- Detail Design and Construction
- Post Occupancy Evaluation

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Dementia Friendly Hosptals from a Universal Design Approach

Grey, T., Xidous, D., Kennelly, S., Mahon, S., Mannion, V., de Freine, P., Dockrell, D., de Siún, A., Murphy, N., Craddock, G., O'Neill, D. (2018) Dementia Friendly Hospitals from a Universal Design Approach: Design Guidelines.

Building Architecture for Health

Rachel Shauer for Dochitect

MICROBIOME'S EFFECT ON ARCHITECUTURE AND ARCHITECTURE'S EFFECT ON THE MICROBIOME

"In Towards a New Architecture, Corbusier's 1923 manifesto for future habitation, he builds upon Haussmann's hygienist legacy. Best known for its proclamation, "A house is a machine for living in," the lines that immediately follow are equally revealing, "Baths, sun, hot water, cold water, warmth at will, conservation of food, hygiene, beauty in the sense of good proportion… We must clear up a misunderstanding: we are in a diseased state because we mix up art with a respectful attitude to mere decoration." The aesthetic imaginary that Corbusier was forming during his years in Paris certainly focused on the architectural qualities of mass, line and surface, but buried within was also an agenda of moral and physical cleanliness that owed a deep debt to Haussmann and the Hygienists.
Looking back, however, there is a very different way to read these passages: as an early salvo in the design profession's century-long campaign to interleave aesthetics with the elimination of microorganisms. Design, it seems, has a long history of violence when it comes to the elimination of germs. Eradicating germs was, of course, the prevailing science of Corbusier's day, influenced by Pasteur's discoveries. Corbusier's espousal of abundant light, circulating air, sterile surfaces, bare floors and no decorative nooks and crannies to harbor little bugs certainly abetted that epidemiological objective. But we are now discovering a new, inconvenient truth for design: that most of those targeted microorganisms, in fact, play a beneficial and even essential role in our good health. That is, the emerging research around our microbiome—those hundreds of trillions of bacteria, fungi, protozoans and viruses (as well as their genetic material) that live in and on the human body—suggests that those antibacterial, "clean" surfaces put at risk colonies of germs that we might actually need to stave off a slew of autoimmune disorders. All of which raises a critical question: given that design has been an active agent in a modern war on microbes, what is its responsibility from this point forward?…
…There are four areas, at least, where designers can develop new frames, new methods and new ideas:

Identity: How will we adapt our understanding of our own selves to account for the 100 trillion microbes that comprise us? What services will we design to foster their resilience and how seriously will we challenge a notion of subjectivity that has been with us for hundreds of years if that egocentrism is inadvertently undermining our own well-being?

Property: Our microbiome is both of us and not of us. Yours might be more robust than mine, or ours. Mine might affect yours…or my home environment might alter yours. One person's dirt might be another's salvation. How are we going to manage the massive, multidimensional ecosystems that both belong to us as individuals and belong to everybody as our ecological commons?

Hygiene: How can we reframe "clean" for an age where filth, grime and invisible creepy crawlies might very well be our saviors? How will our interiors, our kitchens, our bathrooms, our restaurants and our clothing need to evolve in order to welcome our symbiotic friends while still keeping at bay their pathogenic relatives?

Diversity: How can we create the tools and visualization strategies necessary to communicate back to ourselves the relative health and diversity of our own complex microbiomes? What combination of modern medicine, data visualization, wearable (edible?) sensors and visual displays will it take to help us keep track and even increase the resilience of our microbiome?"

–Jamer Hunt, Parsons School of Design

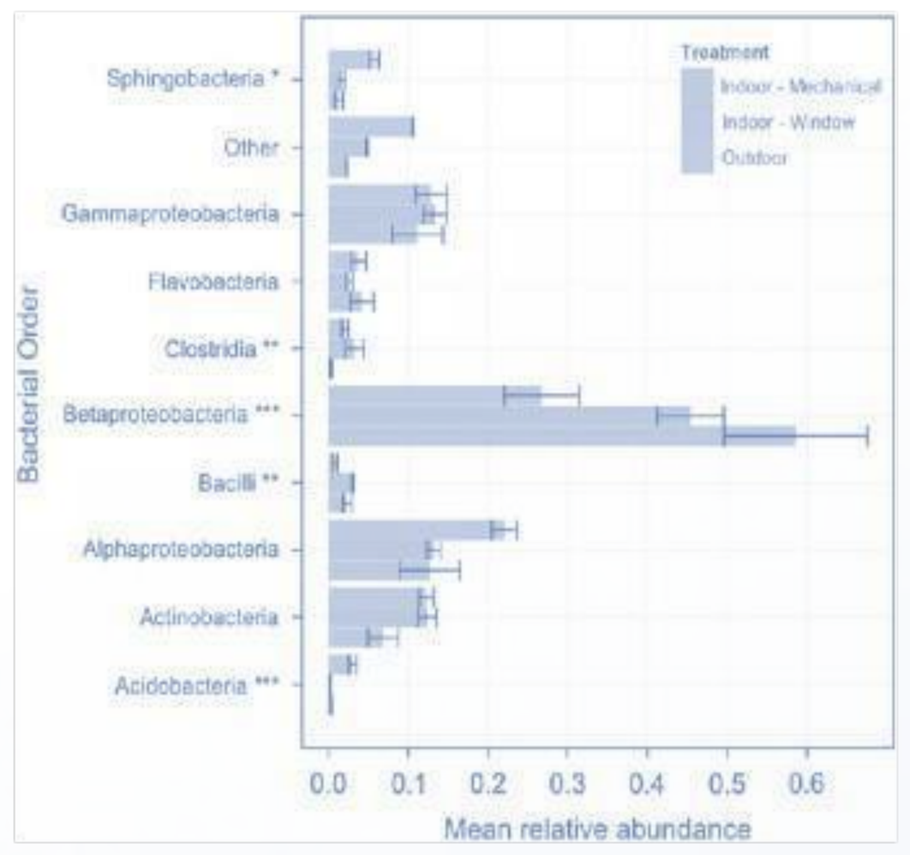


Figure 3 Taxonomic composition of airborne bacterial communities in different environments at a health-care facility: outdoors (blue) and indoors in patient rooms exposed to different ventilation sources (mechanical (red) or window (green) ventilation). Composition estimates (mean ± s.d.) are based on relative abundances of bacterial 16S sequences assigned to different phyla. Asterisk symbols indicate taxonomic groups whose relative abundance differed significantly among ventilation treatments (ANOVA: $^{*}P<0.1$, $^{**}P<0.05$ and $^{***}P<0.01$).

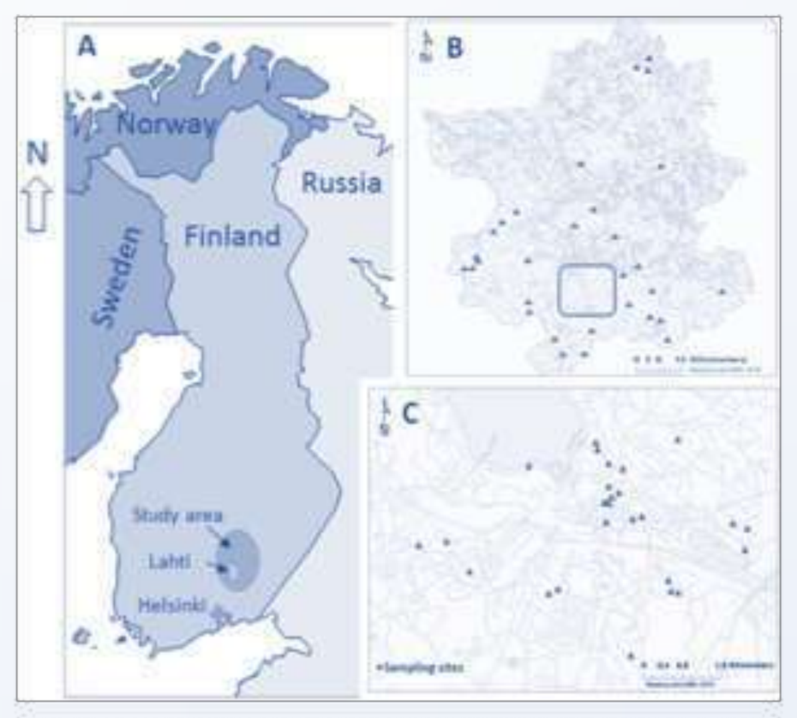


TABLE 1 | Characteristics of urban and rural participants of the study.

	Urban participants	Rural participants
SEX		
Female	11	15
Male	15	15
AGE COHORT		
65–69 years	12	17
75–79 years	14	13
FAMILY		
Living alone	10	8
Living with family member(s)	16	22
DOMESTIC ANIMALS (INCL. PETS)		
Indoors	3	7
Only outdoors	0	7

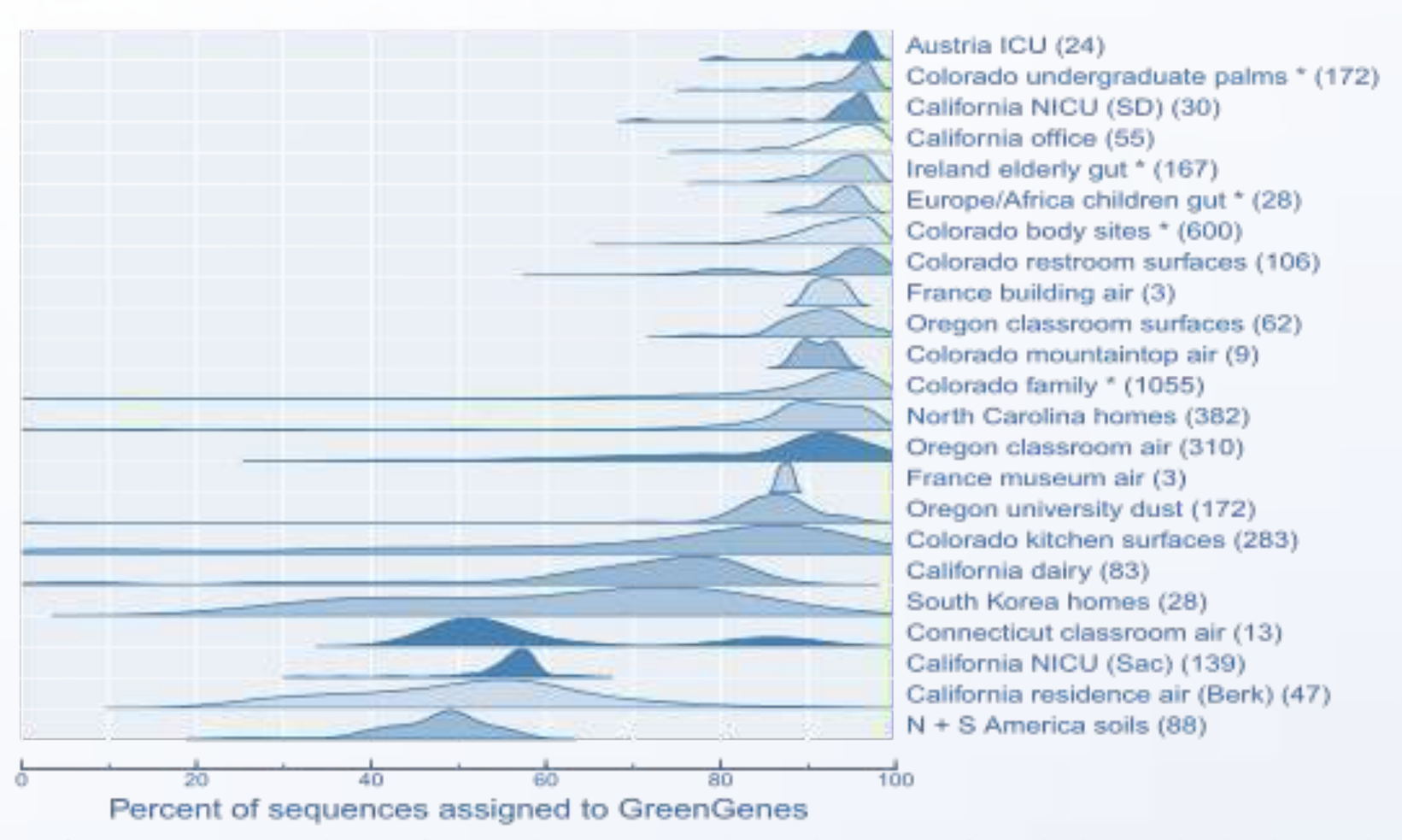
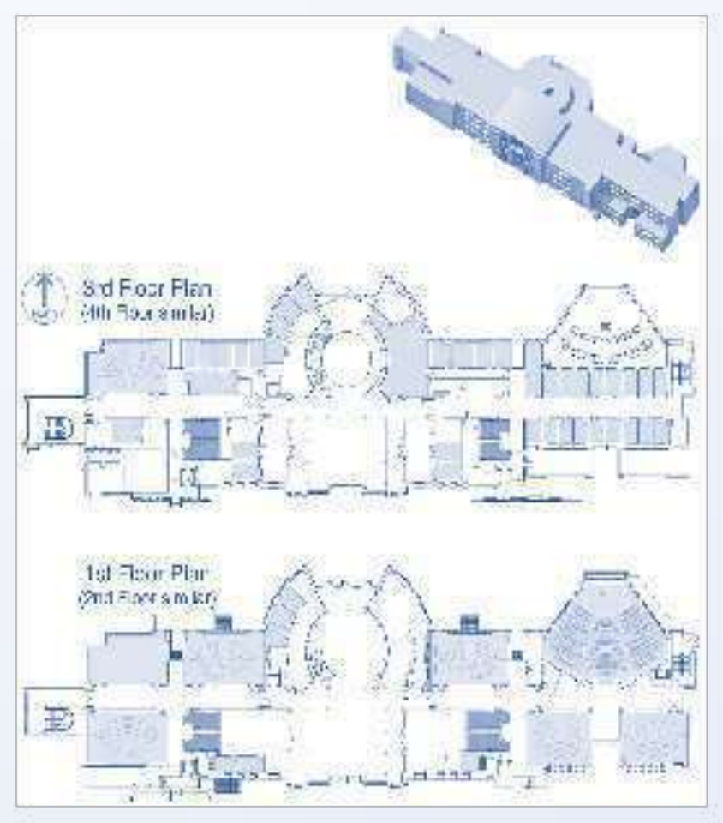
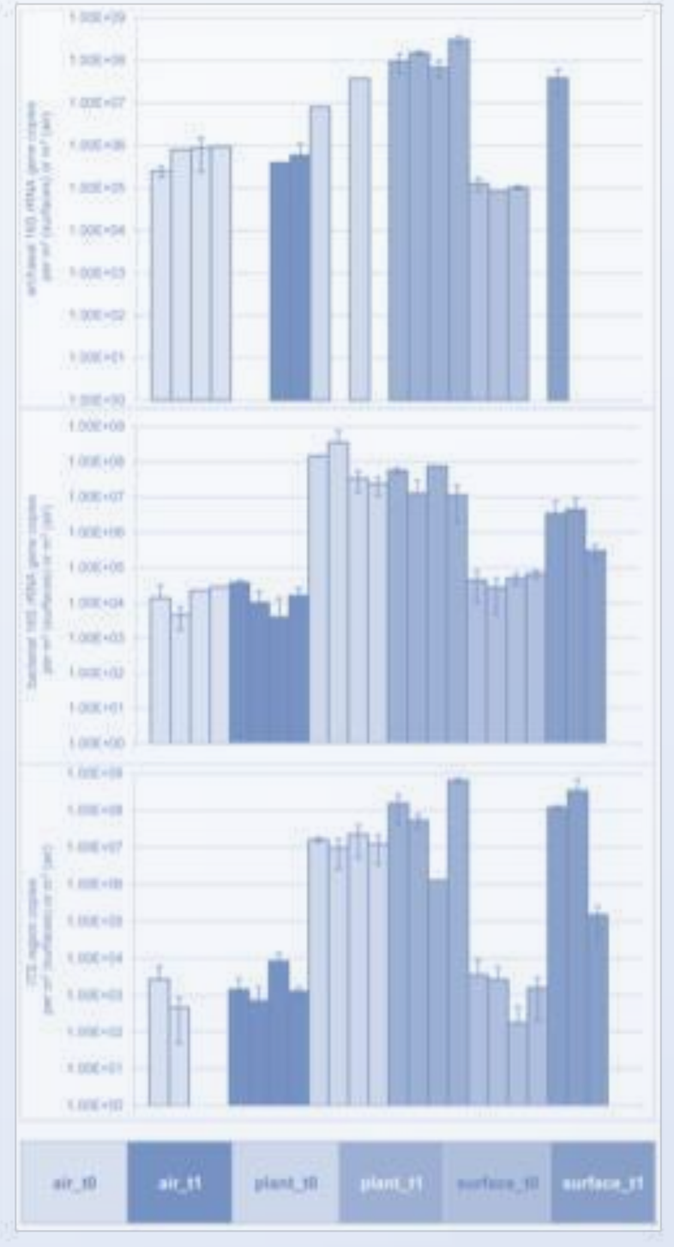


Fig. 4 The proportion of sequences assigned to a reference database varies by study. Datasets from the human body (denoted by asterisk in the figure) and buildings with heavy dispersal from the human body tended to be better represented in the GreenGenes database, while soil and general outdoor sources were not as well represented. The numbers in parentheses show the number of samples in each study





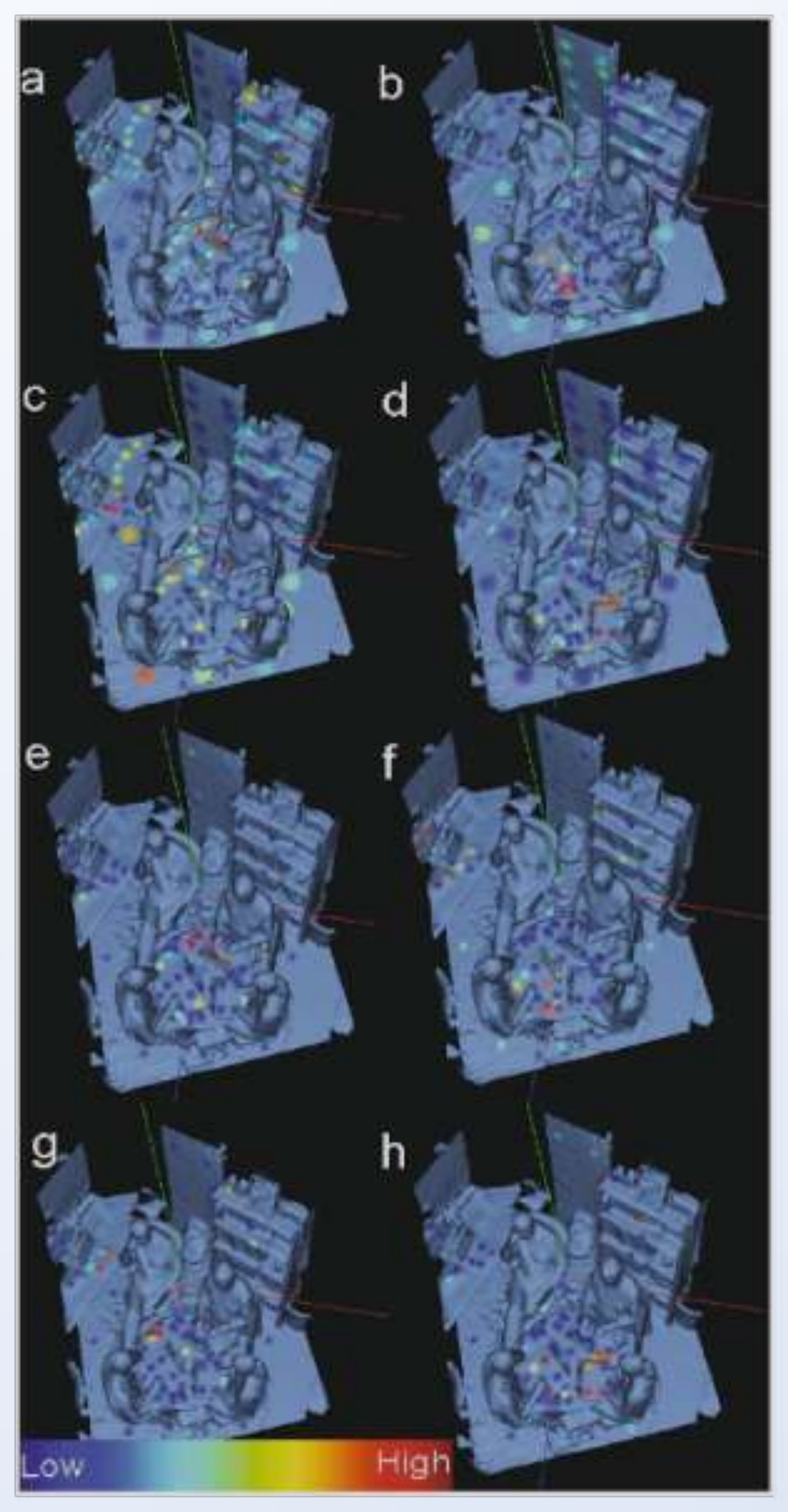
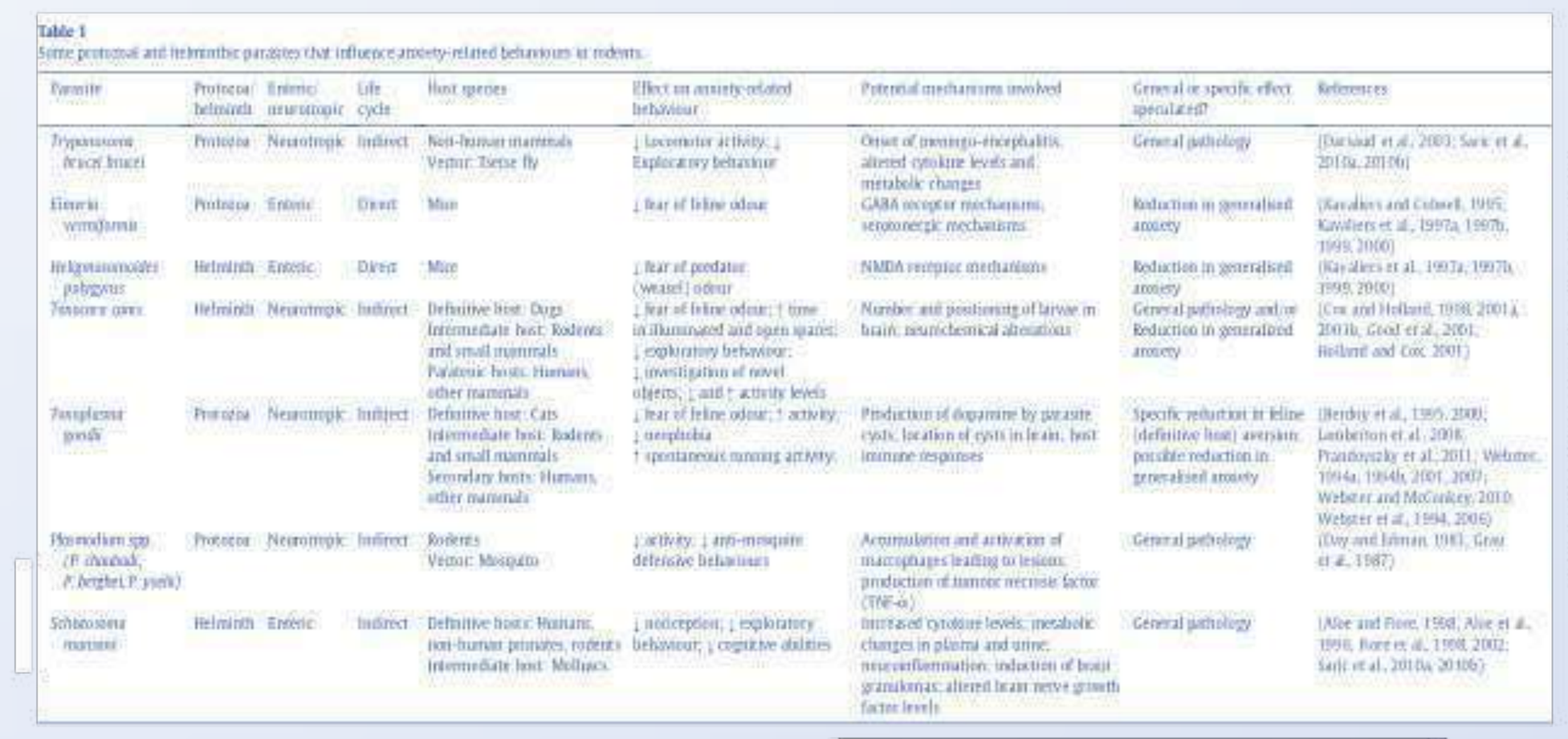


Figure 4. Distinguishing office interactions through chemical and microbial signatures using 3D cartography. Source tracking based on LC-MS profiling (**a–d**) as well as 16S amplicon microbial analysis (1e–h) illustrates the points and intensity of source tracking between volunteers 1–4 and samples sites across the office. Higher probability that molecular features from a sample site belong to a designated volunteer is indicated in red. Blue spots represent a lower probability that molecular features belong to a particular volunteer. Source tracking data based on volunteer 1 is shown in (**a,e**). Source tracking based on volunteer 2 is (**b,f**). Source tracking based on volunteer 3 is (**c,g**). Source tracking based on volunteer 4 are (**d,h**).

Table 2
Mean pre- and post-intervention scores and standard error of the means (shown in parentheses) on the LEIDS-r, BDI and BAI in the Placebo and Probiotics groups. Asterisks indicate significant treatment effect differences between pre- and post-intervention assessments.

		Pre-intervention	Post-intervention
LEIDS-r			
Aggression	Placebo	8.80 (0.94)	8.45 (0.98)
	Probiotics**	8.68 (0.94)	6.25 (0.98)
Control	Placebo	7.65 (0.80)	6.70 (0.82)
	Probiotics	7.25 (0.83)	5.80 (0.82)
Hopelessness	Placebo	5.60 (0.85)	4.70 (0.74)
	Probiotics	4.75 (0.85)	4.0 (0.74)
Risk aversion	Placebo	9.50 (0.93)	9.25 (0.87)
	Probiotics	10.00 (0.93)	7.95 (0.87)
Rumination	Placebo	11.75 (0.90)	11.85 (0.93)
	Probiotics***	11.20 (0.90)	8.25 (0.93)
Acceptance	Placebo	1.40 (0.34)	1.35 (0.37)
	Probiotics	0.90 (0.34)	1.10 (0.37)
Total	Placebo	44.70 (3.24)	42.30 (3.51)
	Probiotics***	42.75 (3.24)	33.35 (3.51)
BDI	Placebo	9.10 (1.00)	9.10 (1.19)
	Probiotics	7.90 (1.00)	7.25 (1.19)
BAI	Placebo	12.21 (1.70)	11.21 (1.69)
	Probiotics	11.35 (1.66)	9.95 (1.65)

* p < .05
** p < .01.
*** p < .001.



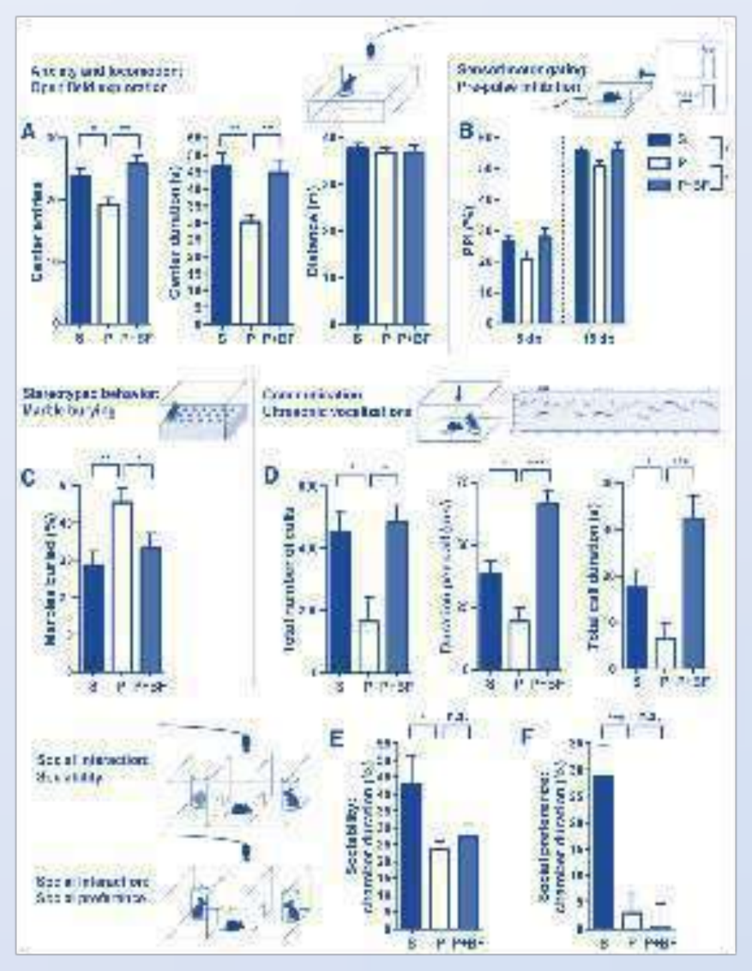


Figure 5. *B. fragilis* Treatment Ameliorates Autism-Related Behavioral Abnormalities in MIA Offspring
(A) Anxiety-like and locomotor behavior in the open field exploration assay. n=35–75/group
(B) Sensorimotor gating in the pre-pulse inhibition (PPI) assay. n=35–75/group
(C) Repetitive marble burying assay. n=16–45/group
(D) Ultrasonic vocalizations produced by adult male mice during social encounter. n=10/group
S=saline+vehicle, P=poly(I:C)+vehicle, P+BF=poly(I:C)+*B. fragilis*. Data were collected simultaneously for poly(I:C)+*B. fragilis*ΔPSA and poly(I:C)+*B. thetaiotaomicron* treatment groups(See also Figures S3 and S4).

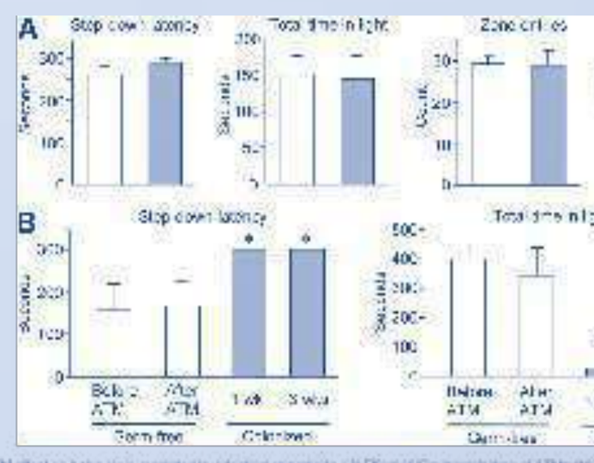


FIGURE 1 The formation, dynamics, and functions of microbiomes in built environments are shaped by complex interactions of factors related to the characteristics of a building, its human occupants, and the microbial communities associated with both.

FIGURE 2 The 12 priority areas in the research agenda will make progress in achieving five goals.

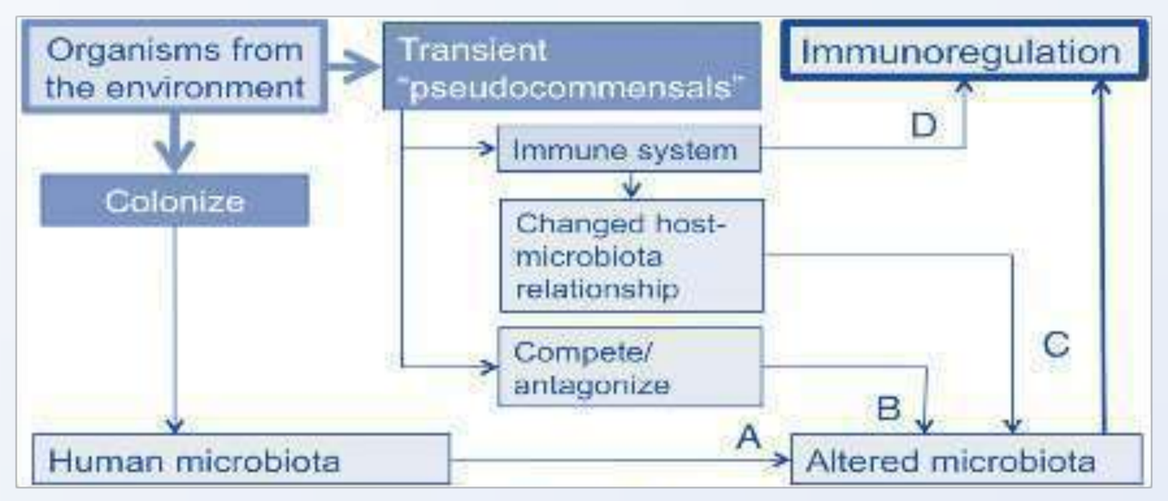
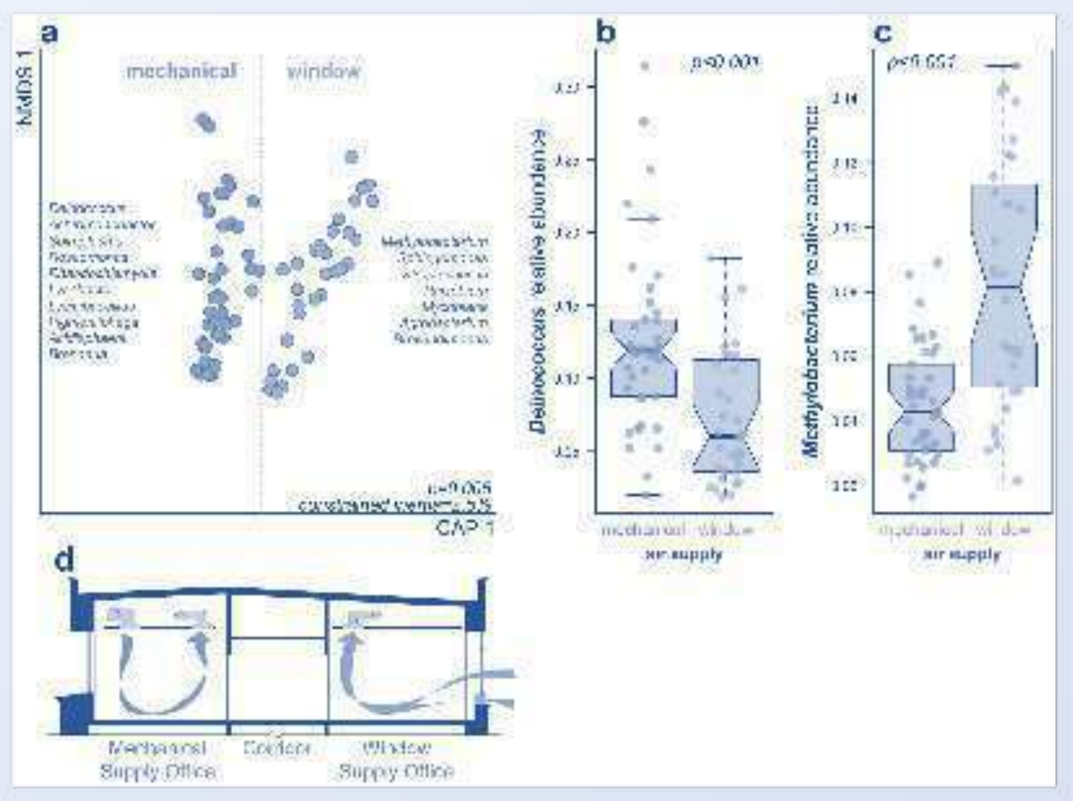
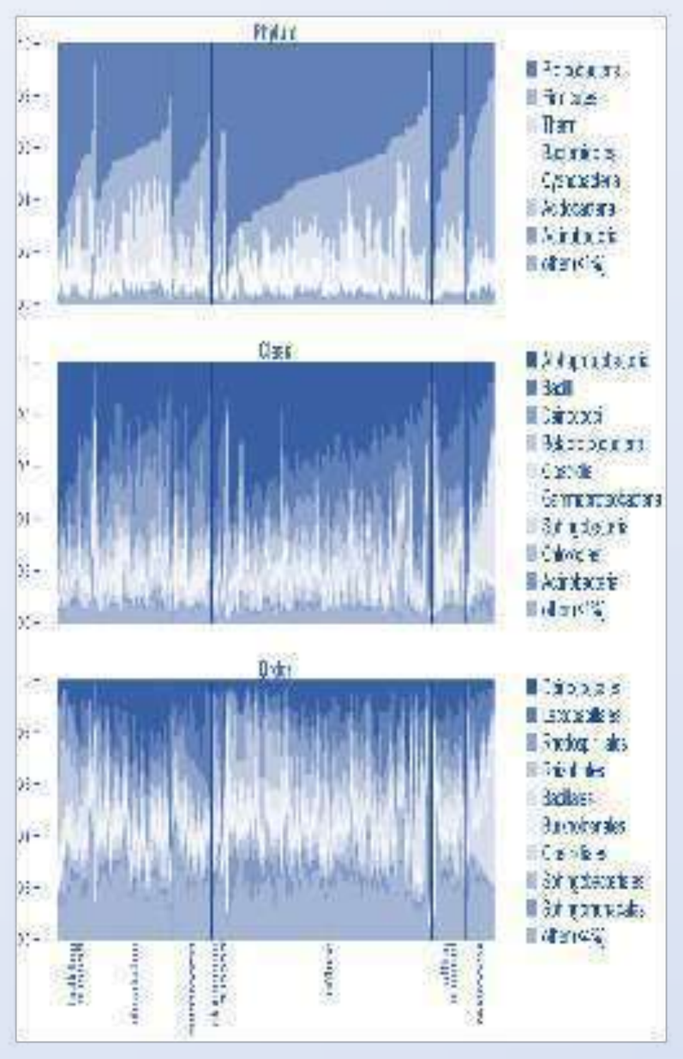
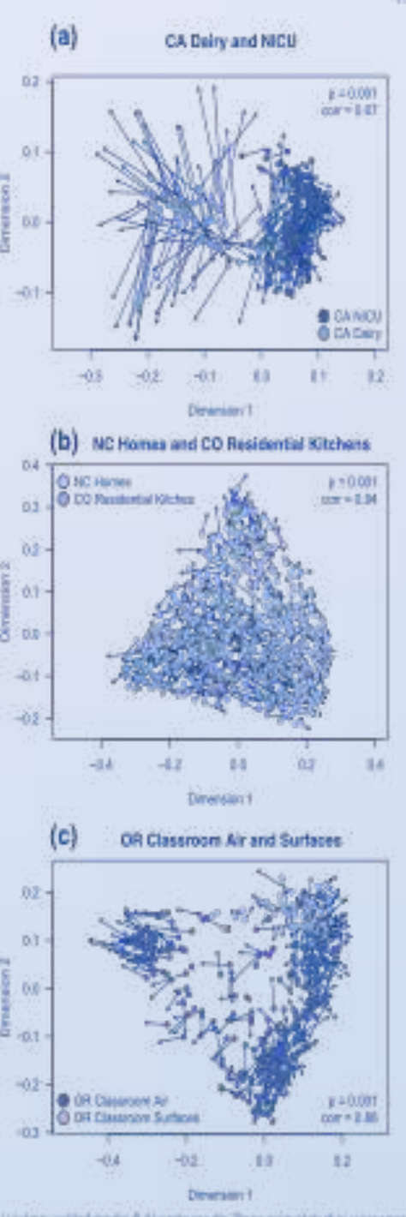


Fig. 3. Multiple ways in which the microbiota of the natural environment can modulate the immune system. This modulation may or may not involve colonization. There can be direct interaction with the immune system (pathway D) or indirect effects secondary to changes in the microbiota (pathways A, B, and C, fully explained in text).







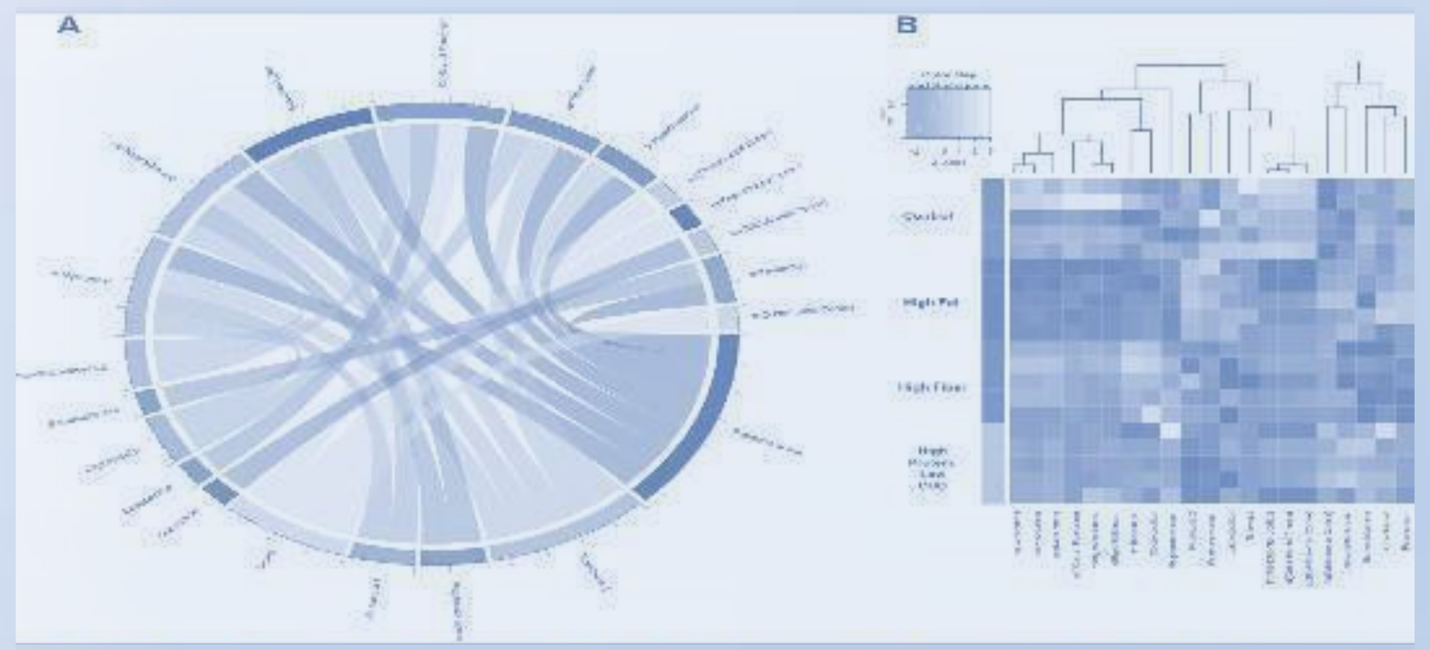
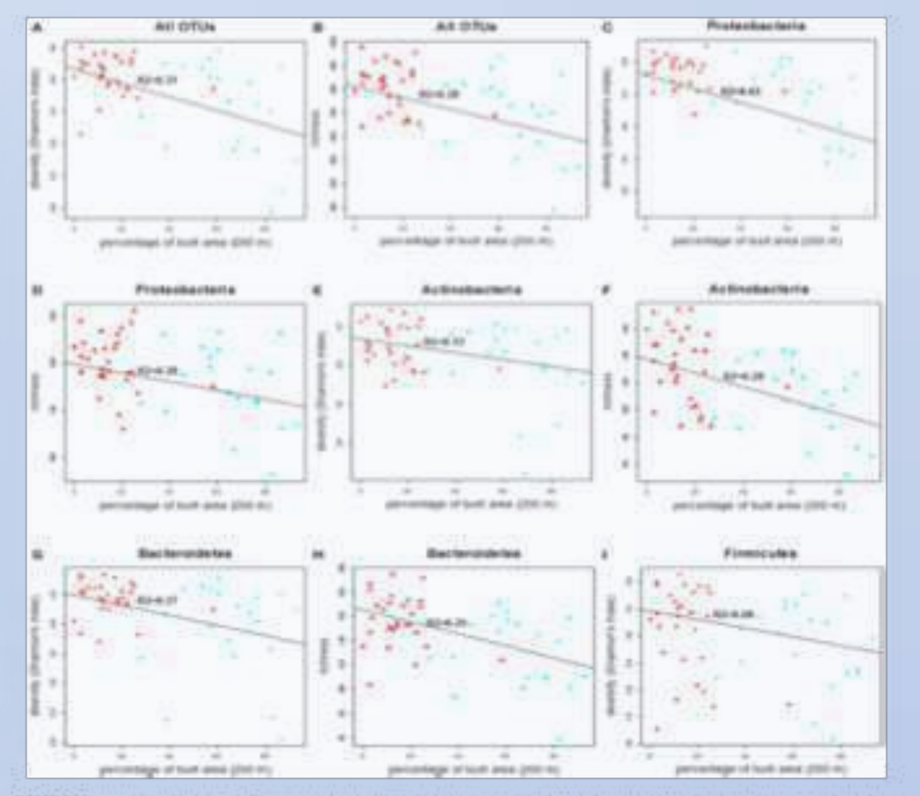


Fig. 4 Specific bacterial populations are predictive of diffusion tensor measurements in corresponding brain ROIs.



Future Directions:

"1. Implement a new model of practice-based research where new and retrofit construction projects are considered as study vehicles to test microbiome theories.

2. Cross-train next generation design scientists who can be healthy building consultants.

3. Use alternative dissemination outlets to reach architectural practitioners, including trade shows, workshops, and design competitions."

–GZ Brown, Jeff Kline, Gwynne Mhuireach, Dale Northcutt and Jason Stenson, University of Oregon, Dept of Architecture and Biology and the Built Environment Center

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Experimental Design for Evaluating the Effect of Lighting Interventions on patients with Alzheimer's: A Review

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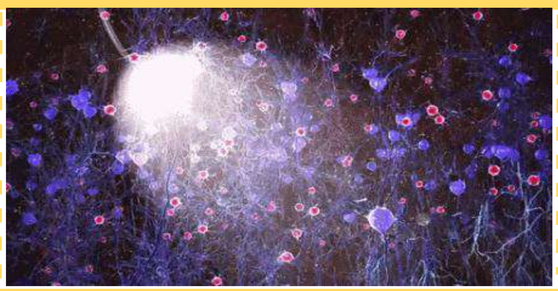
2018 Conference, La Jolla, CA

Introduction

Alzheimer's disease is going to become the major problem for aging population. In 2050, 65% of the aging population (two out of three) will die of Alzheimer's. The question is: Are we prepared and equipped to take care of this increasing population with special needs?" Built environment has a crucial role in his care and cure process. In addition to the guidelines for designing Dementia care facilities, lighting is known as a non-invasive cure method.

Light Therapy: A number of approaches have been used to administer the light stimulus in light therapy studies involving people living with dementia. The most frequently applied approach is the use of a light box, which consists of an array of fluorescent lighting fixtures (e.g. Brite-Lite™ box, Apollo Light Systems, Orem, Utah) which is typically placed at eye level approximately 1m from study participants.

Nevertheless, previous experimental research on this topic is inconclusive since many studies failed to present important variables and strategies used in their experimental designs (e.g. characteristics of the lighting device, time-series design and frequency of the interventions, the amount of light entered into the subject's eyes.



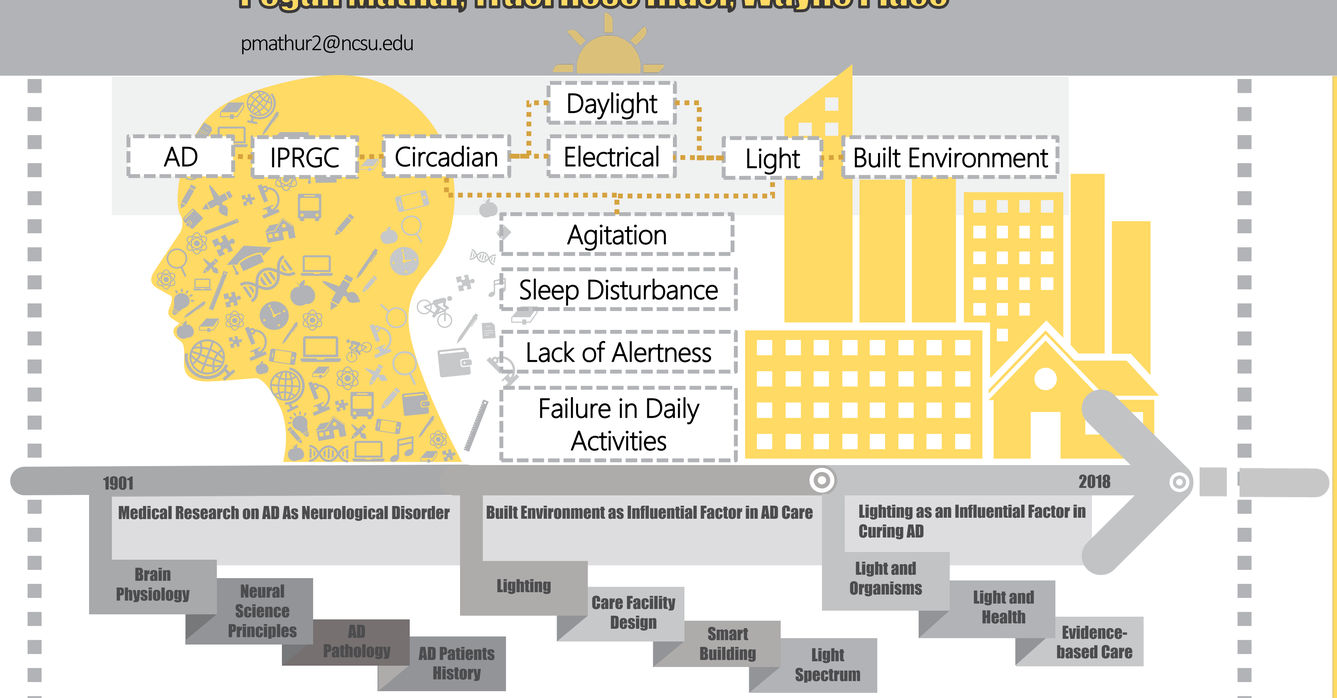
Research Background

Unique visual stimulation may be new treatment for Alzheimer's

Noninvasive technique reduces beta amyloid plaques in mouse models of Alzheimer's disease.

MIT has conducted a research on rodents brain with Alzheimer's disease. This research investigated the impact of LED lights flickering at a specific frequency which can extensively reduce the beta amyloid plaques seen in Alzheimer's disease, in the visual cortex of mice.

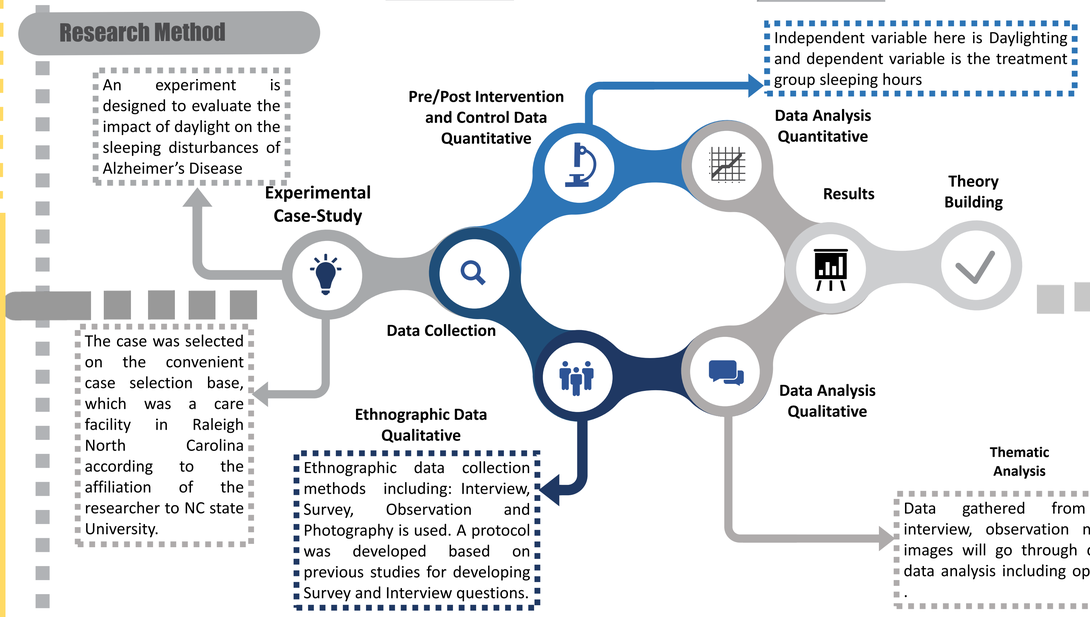
This innovative treatment seems impactful by inducing gamma oscillations range of brain waves, which the researchers identified will help the brain reduce beta amyloid production and restores cells responsible for destroying the plaques. This is a strong evidence for further research to investigate if this light therapy could help Alzheimer's patients.



Research Method

An experiment is designed to evaluate the impact of daylight on the sleeping disturbances of Alzheimer's Disease

Independent variable here is Daylighting and dependent variable is the treatment group sleeping hours



The case was selected on the convenient case selection base, which was a care facility in Raleigh North Carolina according to the affiliation of the researcher to NC state University.

Ethnographic Data Qualitative

Ethnographic data collection methods including: Interview, Survey, Observation and Photography is used. A protocol was developed based on previous studies for developing Survey and Interview questions.

Data gathered from survey, interview, observation notes and images will go through qualitative data analysis including open coding .

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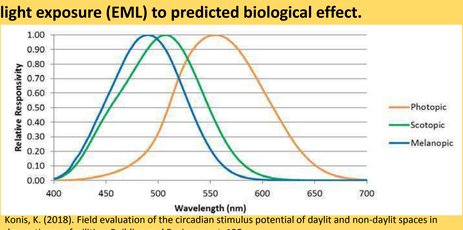
Research Questions and Conceptual Framework

What is the effect of daylight exposure on the disease symptoms of Alzheimer's patients?

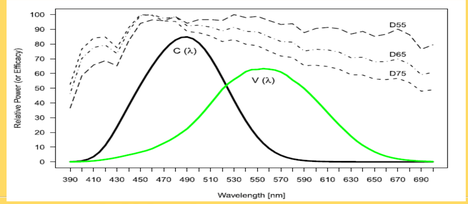
This paper reviews the existing research on lighting and Alzheimer's to develop a framework that gives structure to the design of experimental research on the effect of lighting interventions on Alzheimer's patients (e.g. variables, contextual factors, control strategies).

This framework can facilitate future research on this topic as it enables the researchers to improve the internal validity of their results by improving their research design. Furthermore, this proposed framework can lead to a consistency in defining and using variables, control factors, and applicable findings across different studies to facilitate replication of experimental studies and inform the researcher on the generalizability of the findings.

Dose response curve for 85-year-old observer relating melanopic light exposure (EML) to predicted biological effect.



Konis, K. (2018). Field evaluation of the circadian stimulus potential of daylit and non-daylit spaces in dementia care facilities. *Building and Environment, 135*.



Research Objective

This study reviews the existing research on lighting and Alzheimer's to develop a framework that gives structure to the design of experimental research on the effect of lighting interventions on Alzheimer's patients (e.g. variables, contextual factors, control strategies).

This framework can facilitate future research on this topic as it enables the researchers to improve the internal validity of their results by improving their research design. Furthermore, this proposed framework can lead to a consistency in defining and using variables, control factors, and applicable findings across different studies to facilitate replication of experimental studies and inform the researcher on the generalizability of the findings.

Contributed Posters #6
Saturday, September 22nd | 2:30 – 3:30 PM

John Roth / Los Angeles, California
Design Thinking – Kahn

David Navarrete, Sky Factory / Fairfield, Iowa
Applied Cognitive Architecture: The Restorative Impact of Perceived Open Space

Arathy Gopal, School of Planning and Architecture, Delhi, India / Delhi, India
Aesthetics of Architecture & Vision

Sally Augustin, Design with Science / La Grange Park, Illinois
Applying Neuroscience Research to Boost Creativity

Sarah d'Auriol, Savannah College of Art and Design / Savannah, Georgia
Re-Scripting Urban Interactions Through Architecture: Correlations of Brain Function and the Built Environment

Erica Costa / Brazil
Building Facades as Neurocognition Stimuli

Aishwarya Narayana, Indira Gandhi National Centre For Arts Bangalore / India
Is There Anybody Out There? Anonymity and Aesthetic Emotions in Music and Architecture

Evandro Z. Monteiro, University of Campinas / São Paulo, Brazil
"Here and Beyond": Tynergies between Gordon Cullen's Townscape Qualities and Environment / Behavior / Neuroscience Paradigm

Joe Manganelli, Fluor Enterprises, Kent State University School of Information / Greenville, South Carolina
Agents' Cognition in the Smart City: Agent Architecture Assessment Framework

Amelia Taylor-Hochberg, Massachusetts Institute of Technology (MIT), Cambridge, Massachusetts
Emerging Methodologies of Neuro-Urbanism: Neuroscience's Influence on Architecture and Urban Planning Practice

Alissa Rupp, MIG | Portico / Seattle, Washington
Contemplating Temporal Architecture: Toward Better Buildings and Deeper Neuroscientific Study of Architectural Experience and Perception

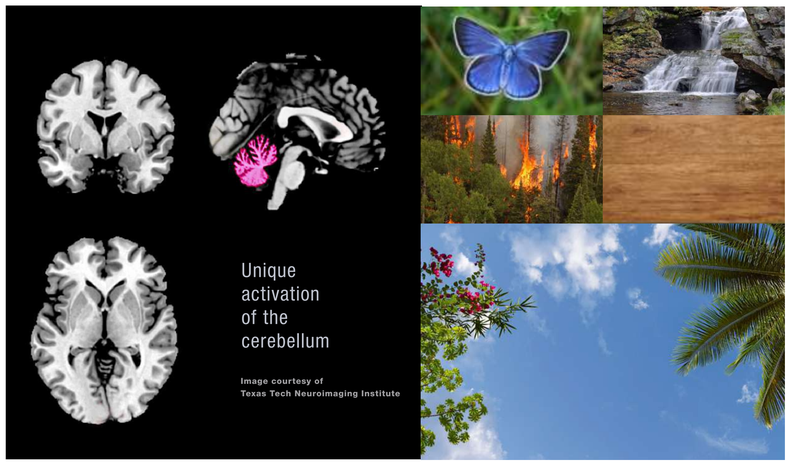
Haonan Lu, University of California, Berkeley / Berkeley, California
Aging with Urbanism – Urban Design with Psychoanalytic Approach

Johanna Jõekalda, Estonian Academy of Arts / Tallinn, Estonia
Shaping Space by Experience Data

Bob Condia & Lucille Z. Sadlon, Perceptions Lab, Kansas State University / Manhattan, Kansas
The Biological Effects of Materials: Visual and Tactile Perception of Environment

APPLIED COGNITIVE ARCHITECTURE:

THE RESTORATIVE IMPACT OF *PERCEIVED* OPEN SPACE



1 COGNITIVE BIOPHILIA

A growing understanding of the neurobiology of spatial cognition will enable architects to superimpose a *cognitive architecture* over its conventional counterpart, effectively altering the psycho-physiological experience of the observer in the built environment. Collaborating with an architect, a neuroscientist, and an environmental psychologist, this study identifies the neural correlates of multisensory imagery, revealing how *illusions of nature* modify perception of place to generate a restorative, biophilic experience of vastness that yields therapeutic benefits.

2 WHAT YOU SEE, YOU BECOME

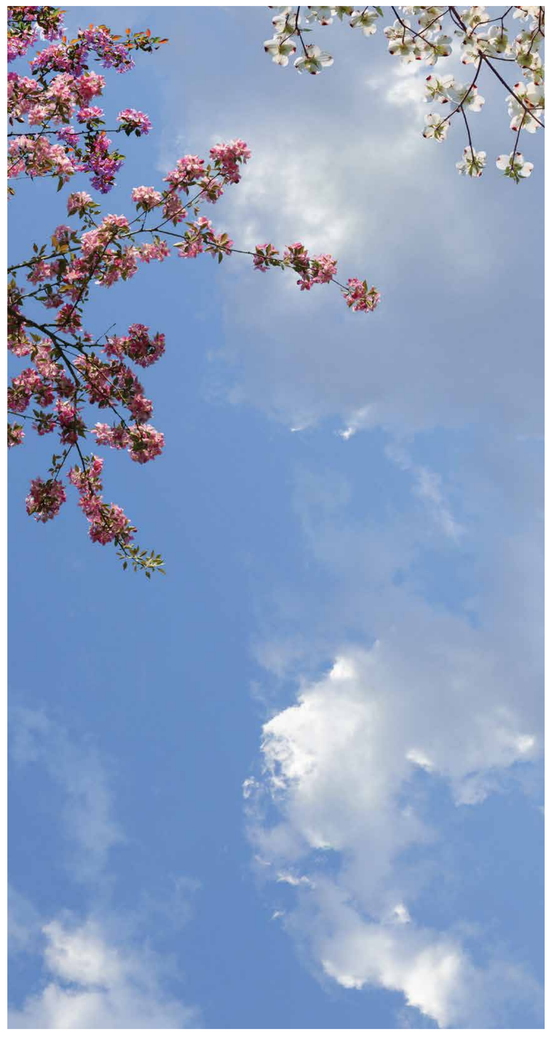
By understanding the malleable nature of the body schema—the integrated neural representation of the body—neurobiology has established that the separation between the observer and the environment is arbitrary (Robinson, 2015). That is, the separation between our cognitive experience of body, peripersonal space, and extrapersonal space is subject to constant revision depending on the attributes or atmosphere of place.

3 NATURE: FROM KINSHIP TO UNITY

The Biophilia Hypothesis proposes a kinship with living systems that presupposed an elemental separation between the observer and nature. However, the notion of embodied perception and the discovery of MN (mirror neurons) reveal that our perception is *action-oriented perception* (Arbib, 2015). That is, our neural simulation of action and movement in others also extends into a dynamic interaction with our environment.

4 BIOPHILIC SPATIAL MAPS AS DESIGN TOOLS

Our emotional assessment of place leads us to extend our sense of self into our environment, or retract from it, into our body proper. This newfound neurobiology of human perception unveils a remarkable opportunity to use *cognitive architecture*—re-wiring our experience of real space in thought—by tapping our memory's spatial maps.



5 EVOKING EXPERIENCED SPATIAL MAPS

Given that the sensorimotor systems we use to navigate space share the same neural infrastructure we employ for higher cognitive functions, including memory, can architects and neuroscientists tap this two-way ('wetware') street to evoke embedded (biophilic) *spatial reference frames* and thereby alter the occupant's experience of enclosed interiors?

6 MULTISENSORY OPEN SKY COMPOSITIONS

We used 3.T fMRI technology to address this hypothesis. Ten participants belonging to five age groups were subjected to short (25 seconds) exposures of 32 images while their brain activation was monitored via the BOLD response. In a separate run, participants were subjected to extended exposures (12 minutes) of photographic *Open Sky Compositions* (multisensory illusions), and an image of a traditional ceiling, in an effort to demonstrate that sky imagery can be: 1) composed to engage our memory's spatial maps, and 2) evoke an experience of vastness.

The study found activity patterns in the brain consistent with our theorizing that multisensory Open Sky Compositions not only share the same patterns produced by positive images, but also produced unique areas of activation, including those associated with spatial cognition and the expansion of space.

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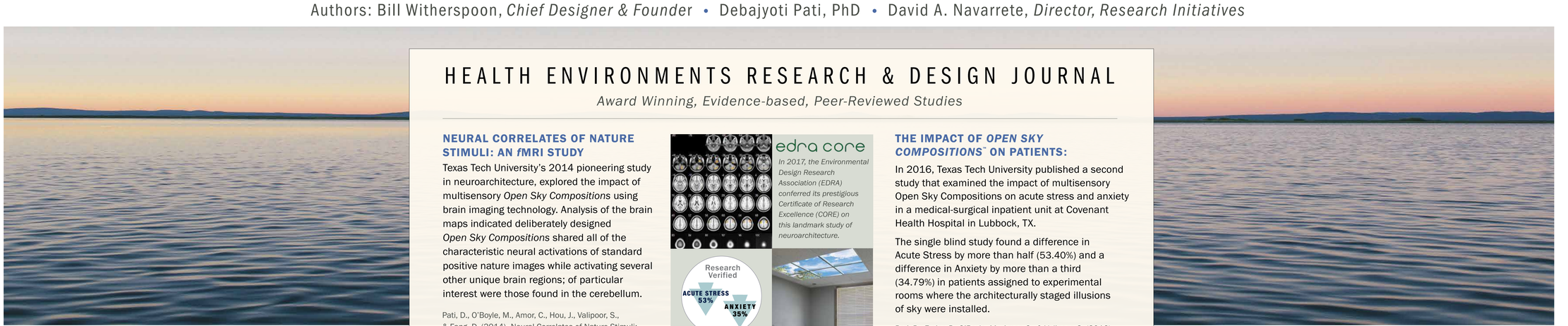
Authors: Bill Witherspoon, *Chief Designer & Founder* • Debajyoti Pati, PhD • David A. Navarrete, *Director, Research Initiatives*



HEALTH ENVIRONMENTS RESEARCH & DESIGN JOURNAL

Award Winning, Evidence-based, Peer-Reviewed Studies

NEURAL CORRELATES OF NATURE STIMULI: AN *f*MRI STUDY

Texas Tech University's 2014 pioneering study in neuroarchitecture, explored the impact of multisensory *Open Sky Compositions* using brain imaging technology. Analysis of the brain maps indicated deliberately designed *Open Sky Compositions* shared all of the characteristic neural activations of standard positive nature images while activating several other unique brain regions; of particular interest were those found in the cerebellum.

Pati, D., O'Boyle, M., Amor, C., Hou, J., Valipoor, S., & Fang, D. (2014). Neural Correlates of Nature Stimuli: An *f*MRI Study. Health Environments Research & Design Journal, 7(2), 9-28.

edra core

In 2017, the Environmental Design Research Association (EDRA) conferred its prestigious Certificate of Research Excellence (CORE) on this landmark study of neuroarchitecture.

Findings in Texas Tech University blind study

THE IMPACT OF *OPEN SKY COMPOSITIONS*™ ON PATIENTS:

In 2016, Texas Tech University published a second study that examined the impact of multisensory Open Sky Compositions on acute stress and anxiety in a medical-surgical inpatient unit at Covenant Health Hospital in Lubbock, TX.

The single blind study found a difference in Acute Stress by more than half (53.40%) and a difference in Anxiety by more than a third (34.79%) in patients assigned to experimental rooms where the architecturally staged illusions of sky were installed.

Pati, D., Freier, P., O'Boyle, M., Amor, C., & Valipoor, S. (2016). The Impact of Simulated Nature on Patient Outcomes: A Study of Photographic Sky Compositions. Health Environments Research & Design Journal, 9(2), 36-51.

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BUILDING FAÇADES AS NEUROCOGNITION STIMULI

AMANDA LEE (US) + ERICA COSTA (BR)
aal345@nyu.edu + erica.amorim.costa@gmail.com

SPACE SYNTAX

This paper reports the first stage of an ongoing research which suggests a methodology to catalog building façades for further measuring of its *in situ* influence (if any) on subjects' physiological responses through the use of portable and/or wearable devices such as skin conductivity bracelets, electroencephalogram helmets and georeferencing by the use of global positioning systems. Previous studies[2] on this matter proved effective to point out built environment does affect both psychological and physiological states on passersby. This study aims to pinpoint usual building façade types to gather on-site physiological data.

The suggested method of cataloging building façades is expected to surpass type description by treating it as interface, i.e., transition between closed private systems, (buildings and its boundaries), and open public ones, (streets and its openness). Both connect at the street level affecting each others patterns of movement. This is Space Syntax Theory primary premise and how it tackles architecture: as connected systems ordering space. The omni urban landscape around us within cities is given shape to a certain society at given time and place conveying individual flux from origin to destination - building to building - through the streets. Hence, spatial form, spatial configuration, is of main relevance to this study as it pertains attributes to control movement on the ground: streets, pathways, gardens, fences, railings, multiple entrances (etc.) - inviting or repelling pedestrians. This categorization will help build a broader concept of façades than description alone.

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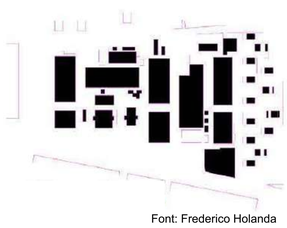

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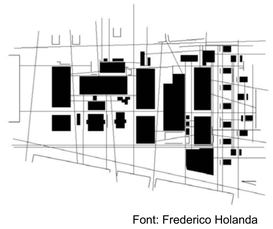

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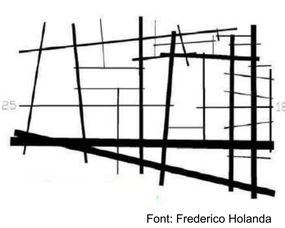

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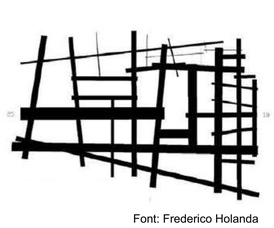

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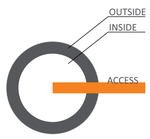
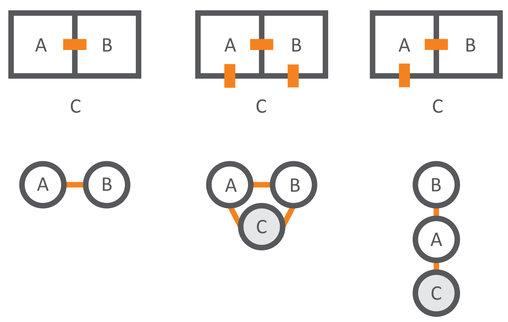
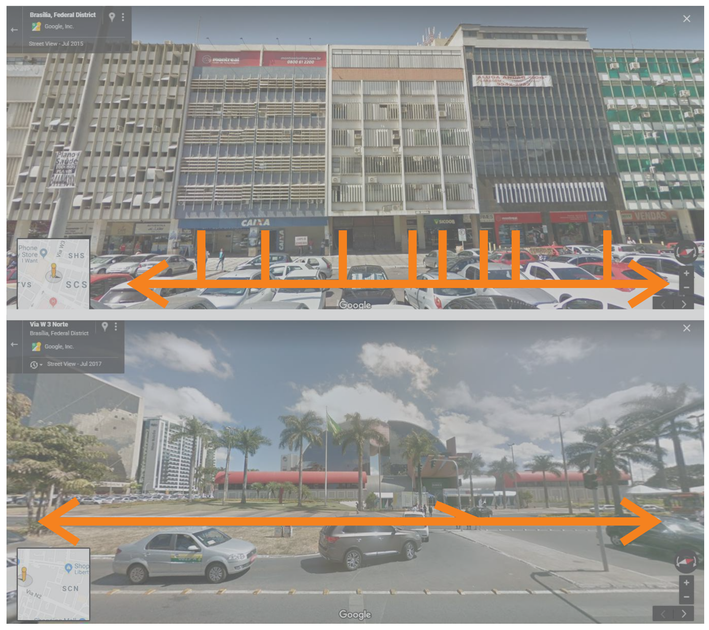
CATALOGING

Recent research crossing Neuroscience and Architecture have indicated subject responses to built environment comparing controlled stimuli such as geometric surfaces and organic surfaces, or green spaces and arid settlements (here roughly described as such for better understanding). Regarding results show clear preference, it's fair to analyze architectural space decoding it into listed elements regularly found in cityscapes and commonly used to induce the relation between pedestrians and buildings. There is a chance these elements are related to city planning mechanisms such as zoning regulation: setbacks and sidewalks width, for instance. Any land use legal instrument promoting a pattern of urban development which might affect pedestrian preferences and therefore routes. Put into another words, planners programming the city to be either friendly or excludent to pedestrians behind a logic which might not reflect overall well-being of those who live in the cities.







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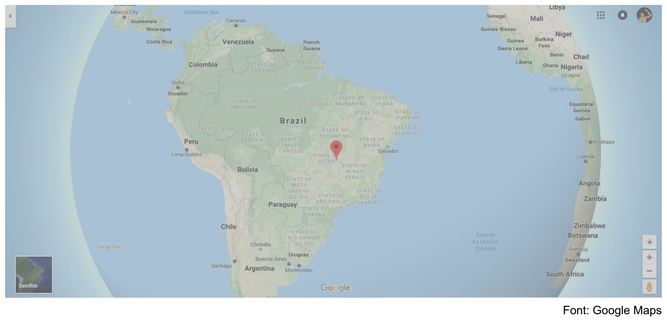
TWO COMMERCIAL SECTORS

The suggested cleavage areas for initial testing of this devise methodology are two commercial sectors less than a mile apart from each other in Brasilia, capital of Brazil. Separated by the Monumental Axis, South and North commercial areas are within same zoning, same size but former was built about 25 years later than the latter. This time frame results in two unique urban samples, being South representative of modernist ideals and North of sectarian postmodernism - local conditions which allow individual performances analysis and later clashing of both data regarding not only influence of a façade type, but immediate collection of façades, Brasilia's Pilot Plan urban planning *per se*, as perceived by pedestrians.



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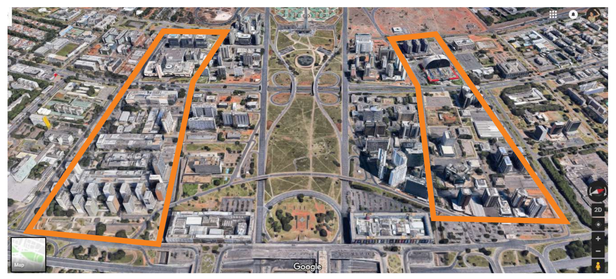

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Is there anybody out there? | Anonymity and Aesthetic Emotions in Music and Architecture

Aishwaraya Narayana
Email - aishwaryanarayana3@gmail.com

Anirudh Gurumoorthy
Email - anirudh_gurumoorthy@gsd.harvard.edu

I Premise

Assumption 1. *Art* elicits emotions.

Emotions accompany and inform our experiences of art, literature, music, nature, or appealing sights, sounds, and trains of thought more generally.[1] Empathetic and Affective responses play a central role in the accounts of forms of art - like music[2,3] and built environments[4,5] are processed.

Music as an Art [6] **-**
- Creation / Process - the link among the composer's intentions, his creative procedures, his mental schemas, and the result of this collection of strategies.
- Expression / Trace - The sound itself, the physical trace (sound-image, a sonority, a score)
- Aesthetic Experience - the description of perceptive behaviors within a given population of listeners; that is how this or that aspect of sonorous reality is captured by their perceptive strategies

Architecture as an Art -
- Creation / Process - "The real architecture only exists in the drawings."[7] Peter Eisenman
- Expression / Trace - "Architecture is geometry."[8] - Álvaro Siza in Imaginar a Evidência (Imagining Evidence)
- Aesthetic Experience - "This is about materials, this is about creating an atmosphere, and this is about creating architecture."[9] Peter Zumthor

Assumption 2. Art elicits *'aesthetic emotions'*

"Aesthetic emotions are aesthetically evaluative emotions because they influence and are influenced by aesthetic judgment. The aesthetic evaluation of stimuli both informs and results from the experience and regulation of aesthetic emotions.[10] In contrast to utilitarian emotions[11, 12] the intrinsic aesthetic appeal of a stimulus rather than its instrumentality for achieving personal goals elicits aesthetic emotions."
- How do aesthetic emotions vary with different forms of art?
- What's the relationship between intended, perceived and felt emotions?
- Are aesthetic emotions affected element-wise or by the overall gestalt?
- How do art forms, inanimate and faceless express the kinds of emotions that we express verbally and non-verbally?
- Can neuroaesthetic research help us identify the musical and spatial equivalents for microexpressions, gestures, emblems etc.?

Assumption 3. Art elicits 'aesthetic emotions' in the observer through an *'empathetic engagement'*.

Empathy as the 'process' of understanding an aesthetic stimuli in a phenomenological experience. This construct of 'empathy' has its roots in the following theories:
- Aesthetic Attunement - The word attunement carries with it a revealing musical connotation, but it also can imply an affective sense of mood or atmosphere.[13]
- Perspective Taking - the tendency to spontaneously adopt others' psychological perspectives.[14]
- Cognitive empathy: the capacity to understand another's perspective or mental state.[15]
- Theory of mind is the ability to attribute mental states—beliefs, intents, desires, emotions, knowledge, etc.—to oneself, and to others, and to understand that others have beliefs, desires, intentions, and perspectives that are different from one's own.[16]
- Affective empathy, also called emotional empathy: Our ability to empathise emotionally is based on emotional contagion: being affected by another's emotional or arousal state.[17]

Questions:
- Can we even empathise with inanimate objects - art?
- In an aesthetic experience - are we empathising with the artist or the art itself?
- How different is it from empathising with people in our lives?
- Does anonymity or signature in an art form affect empathy?
- Are aesthetic emotions by-products of empathy or do they facilitate empathy?


FIGURE 1-3 - Pink Floyd, beyond being the inspiration for the title of this poster, was famous for their innovative soundscapes and the use stage theatrics, most notably a giant wall constructed across the stage to convey the 'sense of alienation' in the album 'the Wall' and Roger Water's personal life during the tours in 1980-81.. SOURCE - http://www.brain-damage.co.uk/the-wall/the-1980-81-wall-concert-performances-in-detail.html, https://mobile.twitter.com/RockWalkLondon/status/961140053459251200/photo/2, https://youtu.be/pnbx00-L_EI

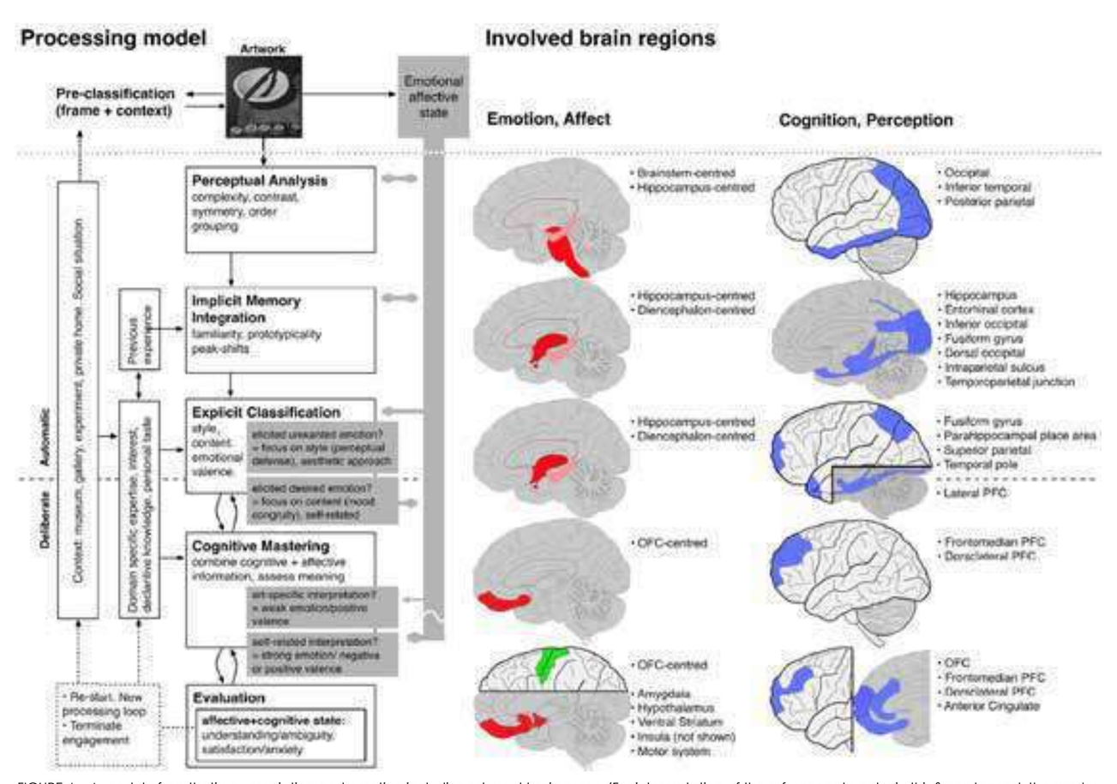
II Research Impetus from Neuroscience in Architecture and Music

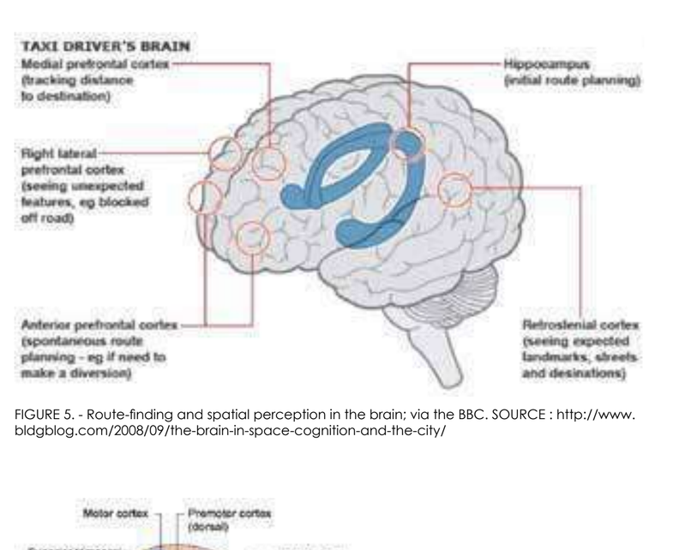
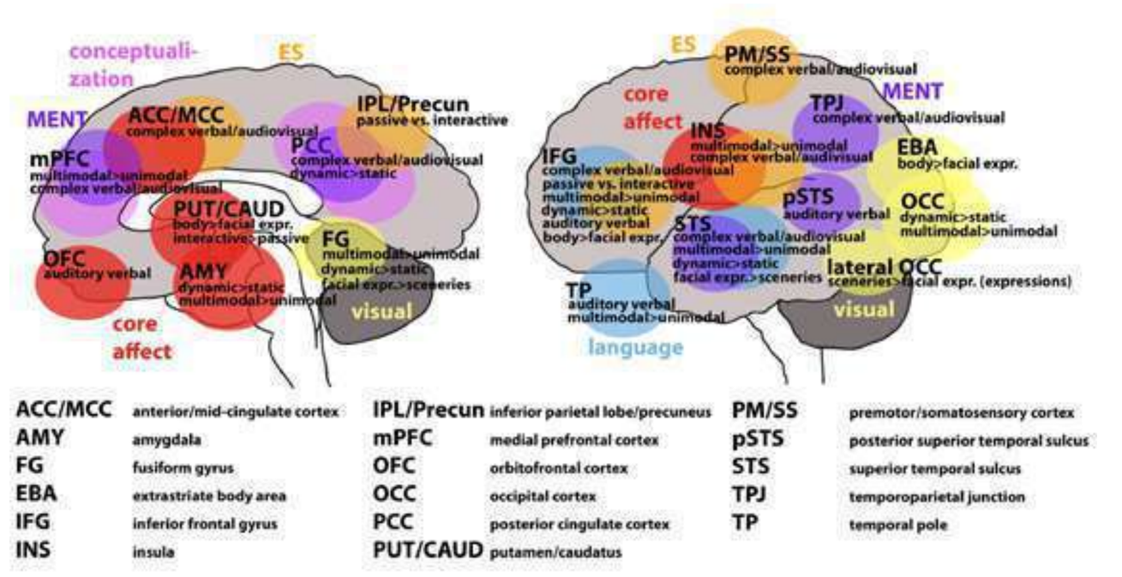
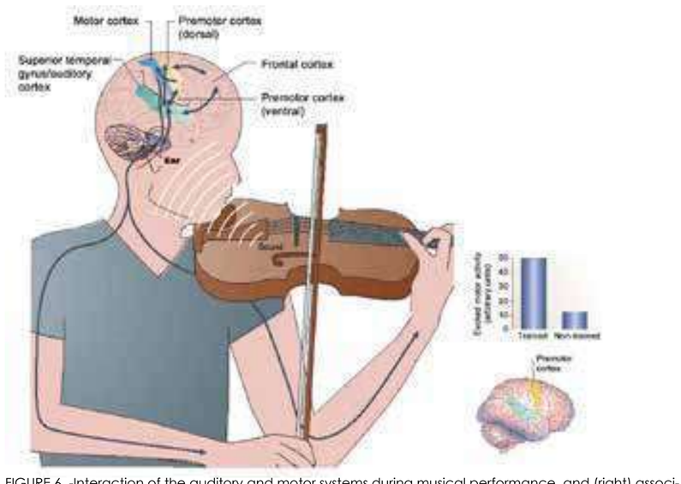
Discovery of 'Place cells' was a crucial discovery that propelled research in the neuroscience of navigation[18], spatial cognition[19], and spatial memory[20, 2]1 etc. Music cognition and emotion perception is being actively researched by National Brain Research Centre, India[22, 23], Zatorre. R[24], Kolesch. S[25], S. Swaminathan and E. Schellenberg[26] among others. Also, the study undertaken by Putkinen et al.[27] extends previous research on the effects of mood on visual attention and indicates that even unfamiliar instrumental music can broaden the scope of auditory attention via its effects on mood. Whereas the cultural aspect of variation has also been studied for music cognition28 as well as language and spatial cognition[29]. Figure 1 shows the aesthetic emotion processing as taken from the works of Ledar et al.[30] Facial expressions, gestures and body movements aid emotional processing in music[31] which makes us wonder whether people look for emotional contagion[32] even in spatial settings. Figure 2 from a study explored emotional impact of different media[33] shows main differences in emotion effects between the various media types and specific emotion effects evoked by more complex media types and an overlap of the key brain regions involved.

Empathy through Embodied Simulation in Architecture and Music

Embodied simulation theory is, amongst other things, a theory of social cognition – a theory of how it is we understand others' actions, basic intentions, emotions and sensations. Gallese states "that the fundamental mechanism that allows us a direct experiential grasp of the mind of others is not conceptual reasoning but direct simulation of the observed events through the mirror mechanism"[34] as facilitated by mirror neurons. "Vision is indeed multimodal: it encompasses the activation of motor, somatosensory and emotion-related brain networks."[35] Also in humans, the motor brain is multimodal. Different — visual and auditory — sensory accounts of the same motor behavior, activate the very motor neurons that normally enable the original action. And Motor simulation instantiated by neurons endowed with 'mirror properties' is probably the neural correlate of this human faculty, describable in functional terms as "embodied simulation."[36]

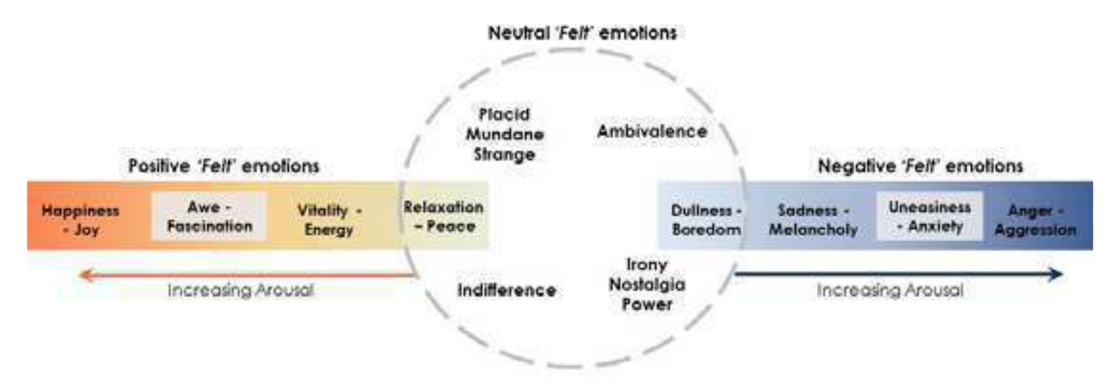
"The perspective of embodied music cognition implies that the human motor system, gestures and body movements play an important role in music perception. The central idea is that an intentional level of musical interaction is established through corporeal articulations and imitations of sensed physical information provided by the musical environment."[37]



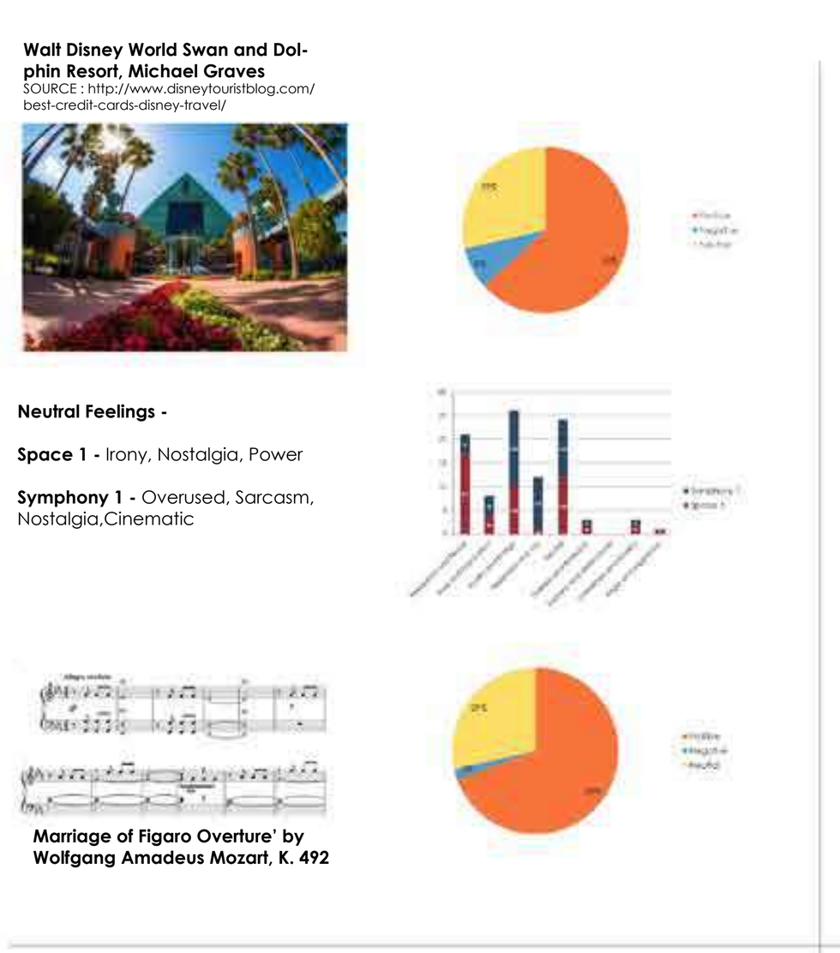





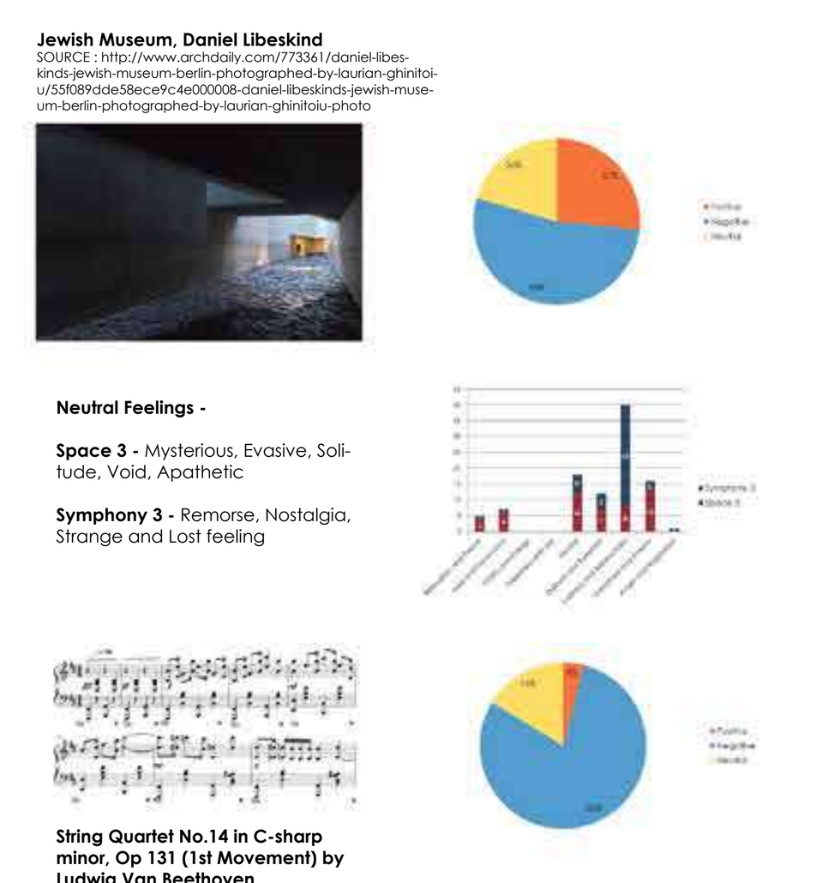
III Pilot Survey for Aesthetic Emotions in Music and Architect

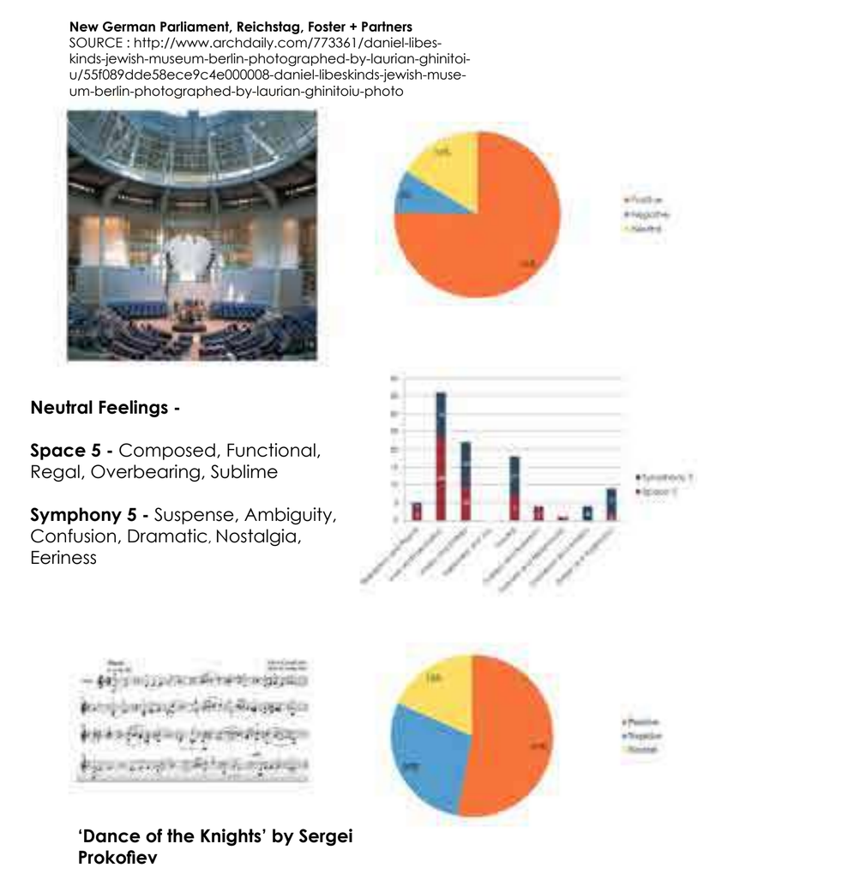
We conducted a pilot survey across 49 respondents (21 architects, 3 musicians and the rest from other backgrounds) to study emotional response to spaces and music intended to induce similar aesthetic emotions (IE). Six such pairs of 'IE' were selected; two for Happiness (Relaxation vs Joy), two for Sadness (Melancholy vs Boredom) and two for Awe (Fascination vs Vitality). The question was to test the emotion 'Valence' as perceived by the respondents, among 'Positive', 'Neutral', and 'Negative'. This was followed by options for 'felt emotions' from the selected valence - For positive valence - 'Relaxation and Peace', 'Awe and Fascination'(positive knowledge emotion), 'Vitality and energy' and 'Happiness and Joy'; For negative valence - 'Dullness and Boredom', 'Sadness and Melancholy', 'Uneasiness and Anxiety' (negative knowledge emotion) and 'Anger and Aggression'. Anyone who picked 'Neutral' was asked to describe the feeling in their own words. Thereafter they were asked to rate the intensity of the emotion felt in the sample and at the end of each pair, compare the intensities between the emotion elicited by the space and music sample respectively.

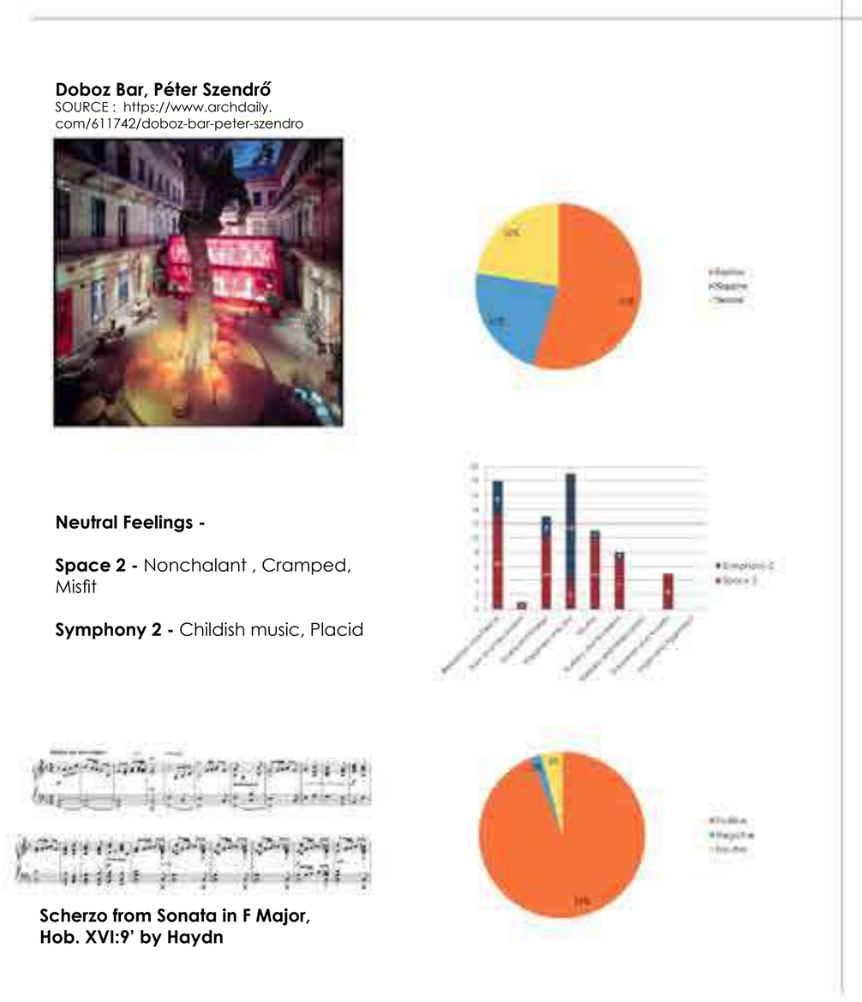


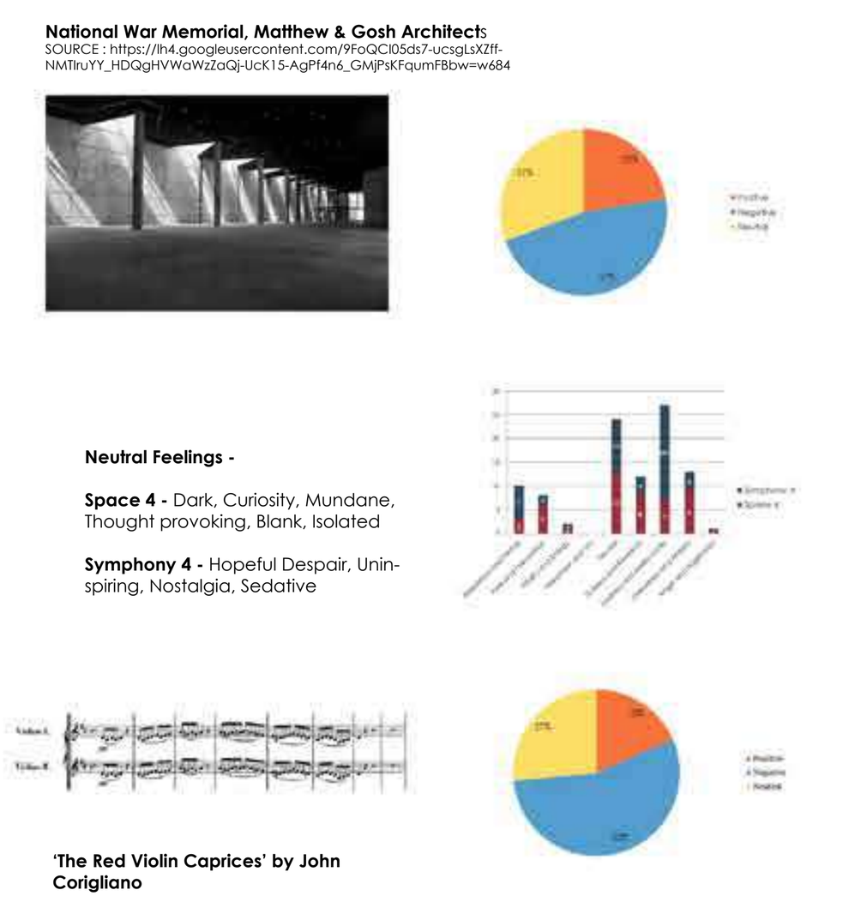
Happiness | **Sadness** | **Awe**

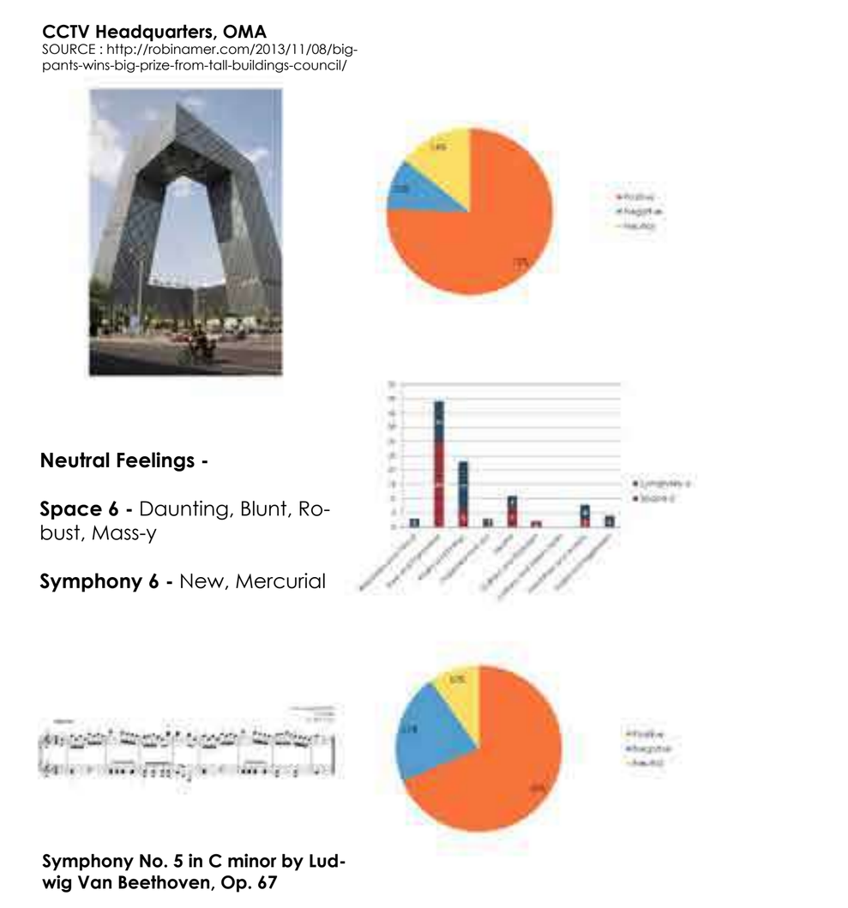












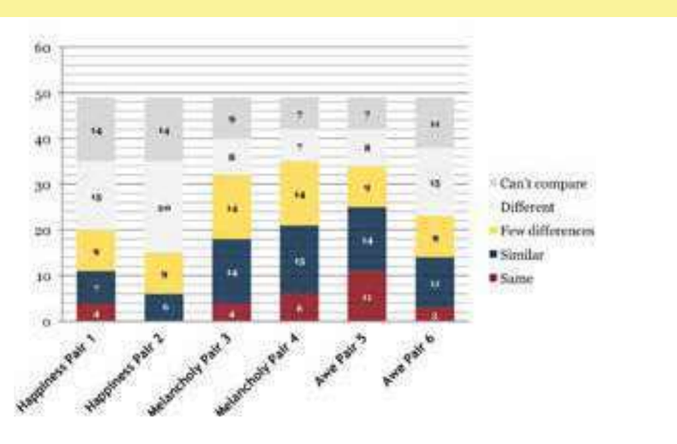
Scenes (Space, Background Score, People/Character) from Movies

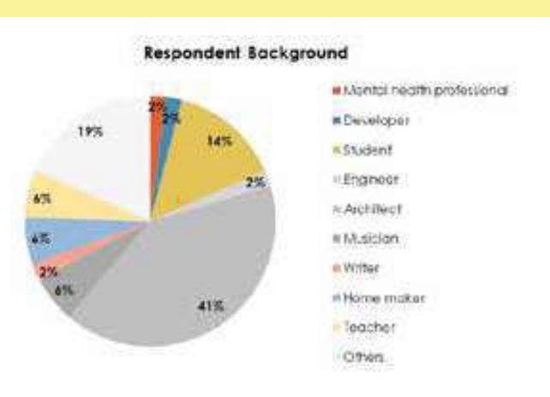
'Forrest Gump Suite' by Alan Silvestri | 'You're So Cool' by Hans Zimmer | 'Summer Overture' by Clint Mansell | 'Theme from Schindler's List' by Itzhak Perlman | 'Drink up, Me Hearties' by Hans Zimmer | 'S.T.A.Y.' by Hans Zimmer

Observations and Inferences

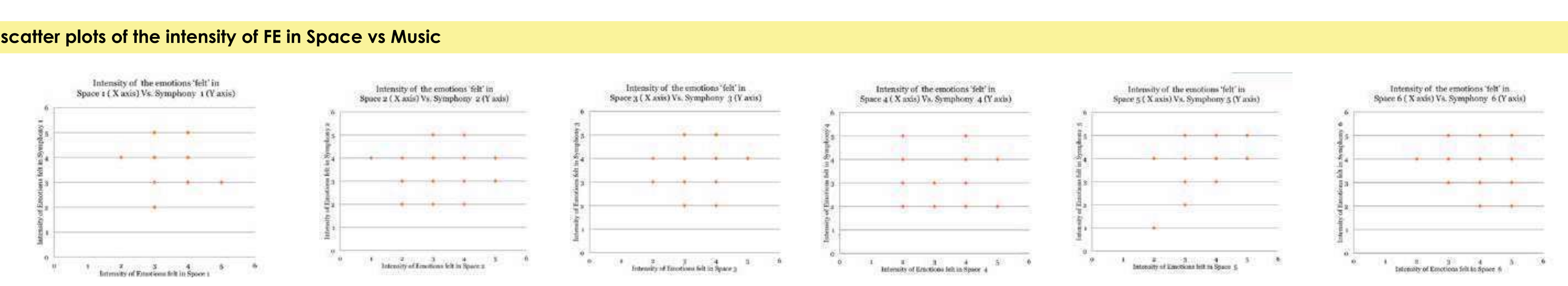
Most people were able to pick the valence congruent with the Intended Emotion of the space and music (IE) but their Felt Emotions (FE) showed a diversity, especially in the first four pairs.
- Relaxation-Peace, Vitality-Energy along with Happiness-Joy were the most recurrent FE in Pair 1 and 2.
- Sadness-Melancholy, Uneasiness and Anxiety and Neutral (Indifference) were the most recurrent FE in Pairs 3 and 4.
- Awe-fascination was easily recognised in Pair 5 and 6 followed by Vitality-energy.

Upon comparing the Intensities of the FE within the Pairs:
- FE (Relaxation, Joy, Vitality and Neutral) in Pair 1 and 2 were perceived as different
- FE (Melancholy, Neutral and Anxiety) were perceived mostly as Similar and some with a few differences.
- FE (Awe and Vitality) were perceived as similar in Pair 5 whereas different in Pair 6.





The scatter plots of the intensity of FE in Space vs Music



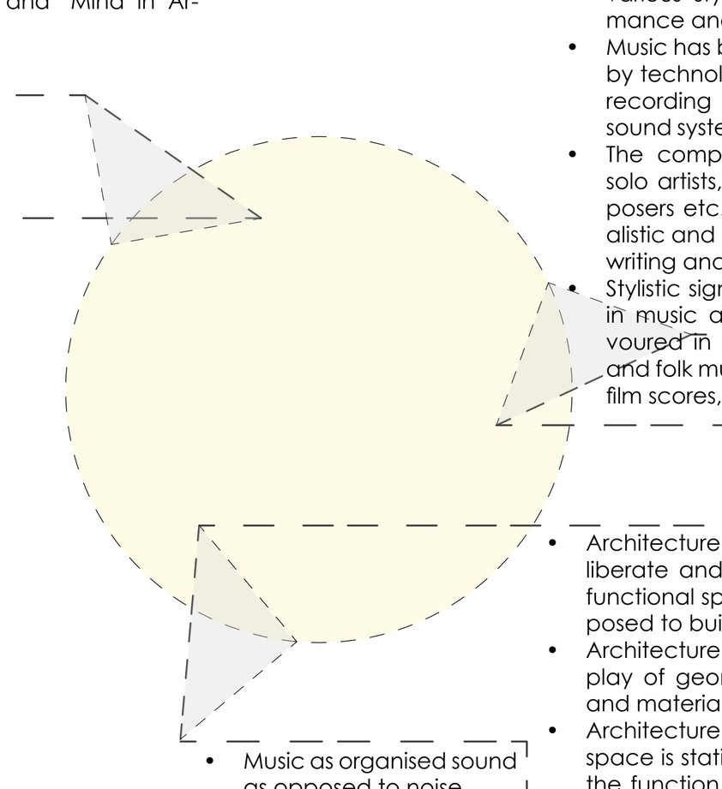
IV Music is liquid Architecture and Architecture, frozen Music.

Johann Wolfgang von Goethe said, 'Music is liquid architecture and architecture, frozen music'. Architecture has been exploring musical influences through projects like Coca-Cola's Beatbox Pavilion[38], Dithyrambalina's Music Box[39], Star Wars Barrel Organ[40], Court of Water Wall[41], Frank Gehry's Walt Disney Concert Hall[42] etc. Whereas theatres, auditoriums, and concert halls have been musicians' second home and architecture has always aided the evolution of music[43]. Both music and architecture thrive in the glory of mathematics[44, 45] – Geometry and material as well pitch and rhythm are objective elements in space-time that elicit a subjective phenomenal experience in the inhabitant/user and audience/listener. We have found that this relationship between the music and architecture (that are also a product of technological, cultural and psychological factors) has a lot to offer to our understanding of how the artist, art, and the observer work together.

Phenomenology of Space
- Perspective taking has a spatial component - "putting oneself in other's place" has an inherent association between self-other distinction that is made in space at a particular time.
- Robert Vischer's ideas of Empathy or Einfühlung explain how we "feel into" or "in-feeling" of works of arts and nature.[49]
- Effects of light[50] and colour of light51 and our reactions to different geometries of spaces[52].
- Emotionality in architecture and the affective empathy it can facilitate alongside phenomenology as a conceptual narrative is being revisited by the works of Steven Holl [53], Tadao Ando[54], and Peter Zumthor[55] alongside publications like 'Questions of Perception'[56], 'Atmospheres'[57] and 'Mind in Architecture'[58].

Architectural Design
- Architectural theory is an accumulation of the critiques, opinions, discourses and stylistic manifestos with very little information about the fundamentals of design. And architectural ideation can be anything from being functional to sensorial to abstract and beyond.
- It mirrors the society as evident in the evolution of various styles and theories over time.
- Technology effects design ideas, representation and communication media, construction and material technology along with management and execution of design on site.
- Architecture during most phases of design is collaborative.
- Although stylistic influences and signature elements often implicate an architect, a school of thought or a particular firm as opposed to the anonymity favoured by most of the pre-Renaissance and vernacular architecture.

Music Composition
- Music theory consolidates the fundamentals of composition, notation and performance whereas ideological themes capture and transcend nearly anything and everything anyone can think of.
- Music formally varies with culture and time, expressed in 'genres' and various styles and forms of performance and composition.
- Music has been thoroughly affected by technology - Analogue to Digital recording techniques, instruments, sound systems for performances etc.
- The composition is undertaken by solo artists, bands, producers, composers etc. It can be both individualistic and collaborative - both while writing and performing.
- Stylistic signatures are often obvious in music although anonymity is favoured in spontaneous (vernacular and folk music) or organised (for e.g. film scores, orchestras) group efforts.



Listening to Music
- Through perspective taking, theory of mind and cognitive empathy can understand the artist's intentions expressed in the lyrical content and the background story associated with the composition.
- Music has universal cues that have been explored for emotion recognition in some cross-cultural studies as well.
- 'Time Theory' in Hindustani Classical Music has been appropriated to suit the effects of diurnal changes on emotion perception.[46]
- The expression of happiness is associated with faster tempo, a high-pitch range, and a major rather than minor interval, and these cues are reversed in musical expressions of sadness.[47]
- Why some people seek out happy music and while some enjoy sad music and how music training is also predictive of intense emotional responding to sad-sounding music has been explored in some studies.[48]

Musical Objects
- Music as organised sound as opposed to noise.
- Music as a thoughtful organisation of spatially differential elements (on the sound wave-form) like pitch, rhythm and sonorous materiality as expressed in the timbre of the instruments.
- Music can be captured in space-time through a live artistic performance, a recording or as a score.

The Architectural Object
- Architecture as a deliberate and evocative functional space as opposed to buildings.
- Architecture as an interplay of geometry, light and materials.
- Architecture as a built space is static although the function and experience changes over time; drawings, models and other forms of representation are also means of capturing the essence of architecture in time.

V So what if Music is liquid architecture and Architecture, frozen music?

Architectural Design and Pedagogy

Affective computing (sometimes called artificial emotional intelligence, or emotion AI) is the study and development of systems and devices that can recognize, interpret, process, and simulate human affects.[59] As an application of this technology one could look at developing better and scientifically validated affective parameter plugins for Building Information Modelling software, averting the dreaded 'dead-on-the-inside-and-outside' architecture. Adding the dimension of human behaviour and emotions to design tools can facilitate holistic analysis of the performance of architectural designs. When used in conjunction with Augmented and Virtual Reality Platforms, the knowledge about emotion perception can be effectively incorporated at every stage in the design. This could also help more architects to get better acquainted with the emotional aspects of design and get inspired by endeavours like Michael Arbib's 'Neuromorphic Architecture'[60] that seeks to explore intelligent spaces mindful of their fully functional brains.

When it comes to pedagogy, environmental psychology is far from being an actively taught and learnt course in the curriculum of most architecture schools. Moreover the scientific data available of the emotional impact of designs is sparse. Not only do we need to study this scientifically and curate the lessons to make designs more psychologically attuned to its inhabitants and users but also to help architects realise and manifest the full potential of their intellectual propositions alongside their affective and behavioural outcomes.

Empathy, Emotions, And Neuroaesthetics

Insights into the neural substrates of Aesthetic Emotions elicited by different aesthetic stimuli. Once we start considering 'consciousness', 'personality differences', and the larger aspects of our ethos beyond anthropology and the socio-cultural paradigm, exploring the dynamic relationship between music and architecture through sounds and spaces might lead us to the very cornerstone of humanity's emotional heritage and where we might be headed - especially in these times of socio-political, economic and ethical frailties caught nearly ready to host a tea-party for our digital doppelgängers.

VI Acknowledgments

We'd like to thank Dr. Deepti Navaratna, Architect Dev Bildikar, Hymavathy B. and Nitin Hugar for helping us put together the ideas we have shared in this poster.

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Agents’ Cognition in the Smart City: An Agent Architecture Interaction Assessment Framework

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Abstract

This paper presents an agent architecture interaction assessment framework developed using constructs and measures from architecture [1, 12, 18, 26, 27, 28, 35, 46], agent-based modeling [15, 52], human factors [36, 38, 39, 40, 45, 49, 50, 51], systems science & engineering [5, 6, 17, 12], cognitive science [1, 13, 20, 22, 23, 41, 47, 48, 53], neuroscience [19, 20, 37] and evolutionary biology [19, 34, 42]. This work elaborates the ANFA Conference Mission, *“…the range of human experiences that occur in context with elements of architecture, both exterior and interior...”* by expanding the constructs of ‘human’ to ‘agent’ and ‘elements of architecture’ to include all physical and non-physical architectures that function as part of an agent’s ecological niche [18]. This reframing of the constructs of and relationships between humans and architecture is useful for modeling and analyzing interactions between humans, other intelligent agents, and their environments, because it puts all agents and environmental elements into one unified representational framework, defining them through a single, consistent, comprehensive schema with shared constructs and measures. This agent-based information processing systems assessment framework is especially useful now, as designers and researchers develop new constructs, methods, and tools for modeling, analyzing, simulating, and designing smart environments (e.g., smart cities, intelligent buildings, interactive environments, augmented cognition, etc.) [3, 4, 26, 43]. As part of expanding the sense of what constitutes a ‘cognizing agent’ and an ‘architecture’, readers/attendees are introduced to emerging system types, including: complex, interactive architectural systems (CIAS) [1], cyber-physical systems (CPS) [16, 24, 25, 31, 32, 54, 55], socio-technical systems (STS) [14], cyber-social systems (CSS) [30], ultra-large scale systems (ULS) [33], complex, large, integrated, open systems (CLIOS) [10, 29, 44], multi-scale systems (MSS) [21], and the Internet-of-Things-Enabled Smart City Framework [4, 30]. These emerging systems entail increased complexity, a high degree of real-time interactivity between agents (people, buildings, other organisms, hardware, software), and an accelerated rate of adaptation/evolution [26].

Need

Environmental design is an ethical act because the environments we create challenge and/or affirm people’s beliefs and enhance or degrade their sensory perception, cognition, task performance, and well-being. As Winston Churchill noted, “We shape our buildings and afterwards our buildings shape us.” [7] This same sentiment, expressed from an extended mind perspective is,

> *“In all this we discern two distinct, but deeply interanimated, ways in which biological cognition leans on cultural and environmental structures. One way involves a developmental loop, in which exposure to external symbols adds something to the brain’s own inner toolkit. The other involves a persisting loop, in which ongoing neural activity becomes geared to the presence of specific external tools and media…..the true power and beauty of the brain’s role was that it acted as a mediating factor in a wide variety of complex and iterated processes, which continually looped between brain, body and technological environment, and it is this larger system that solved the problem.”* [8]

In summary, by the environments we make, we, *“…make better worlds to think in.”* [8] Our environments and tools are extensions of our minds. Architects and environmental researchers and designers should develop design and analysis tools to model and assess the likely beneficial or detrimental impacts of design decisions on human sensory perception, cognition, task performance, and well-being during the design process.

Goal

Environmental designers and researchers should develop constructs, measures, methods, and tools to simulate the likely impact of design decisions on sensory perception, cognition, task performance, and well-being during design, construction, and on an ongoing basis during organizational use. As a first step toward achieving these goals, people and their environments and other tools must be placed in a shared representational framework. If people’s sensory perception, cognition, task performance, and well-being cannot be modeled directly in relationships with environmental structures and behaviors, then it is not possible to simulate and analyze how those environmental and tool affordances likely impact sensory perception, cognition, task performance, and well-being.

Context & Challenge

The challenge of developing such a shared representational framework is made more arduous by the current proliferation of complex and interactive systems and software, in our environments and as parts of our daily routines, as well as their rapid paces of evolution. This complexity, interactivity, and the rapid rates of change of these technologies increases the challenge of creating such a shared representational framework while also increasing the need for such a framework. Humans currently innovate and evolve their environments and behavioral routines faster than the concomitant changes to sensory perception, cognition, task performance, and well-being can be integrated into our work processes and cultures. How can we design systems of cognizing and socializing systems so complex that none of the designers or users completely understands what is being designed, what its boundaries are, how best to design it, how best to simulate/test/validate its performance, or how it will impact the sensory perception, cognition, task performance, and well-being of individuals and groups?

Approach

This paper uses agent-based modeling constructs and methods to frame the relationships between human, non-human, physical, and non-physical agents. It presents an agent architecture interaction assessment framework --- a shared representational framework for humans and their environments and tools --- designed to be useful for creating and analyzing models of how environmental design decisions likely impact human sensory perception, cognition, task performance, and well-being.

This approach is useful, especially now, as designers and researchers develop new constructs, methods, and tools for modeling, analyzing, simulating, and designing smart environments (e.g., smart cities, intelligent buildings, interactive environments, augmented cognition, etc.). Emerging system types, including: complex, interactive architectural systems (CIAS), cyber-physical systems (CPS), socio-technical systems (STS), cyber-social systems (CSS), ultra-large-scale systems (ULS), and complex, large, integrated, open systems (CLIOS), expand the sense of what constitutes a ‘cognizing agent’ and an ‘architecture’. These emerging systems entail increased complexity, a high degree of real-time interactivity between agents, and an accelerated rate of adaptation/evolution.

Framework

The *agent architecture interaction assessment framework* treats all forms of processing --- whether physical or non-physical activities, as cognition. In addition, methods for measuring information content and information gain for agents engaged in processes are calculated. [56] Information gain is assessed with respect to overall quantity transformation from beginning of process to end of process, as well as assessment of rate of change, number of dependencies, number of dependents, centrality, and membership in neighborhoods of information. In addition, the stability and fault-tolerance of the information processing between agents are assessed in order to determine the resilience of the information processes enacted by the agents. Lastly, a weighted assessment of information processes per agent in relation to overall system goals is performed in order to validate usefulness of the information process with respect to a purpose. [57] (See Figure 1 and Figure 2)

This toolkit of assessments is performed with respect to four information processing domain constructs adapted from the theory of ecological niche construction in evolutionary biology. An agent’s interactions are assessed with respect to the broad categories of ecosystems engineering, modification of selection pressures, ecological inheritance, and adaptation. [34] Through this analysis, it is possible to develop a relative assessment of the information content gain or loss (overall effect) of a design decision on agents’ processing as well as a sense of the arduousness of the transition (amount of change needed to achieve a threshold value) per area of focus. This is a first step toward facilitating a cost/benefit analysis of the impact of design decisions on sensory perception, cognition, task performance, and well-being in order to make more useful and healthy decisions about design interventions.

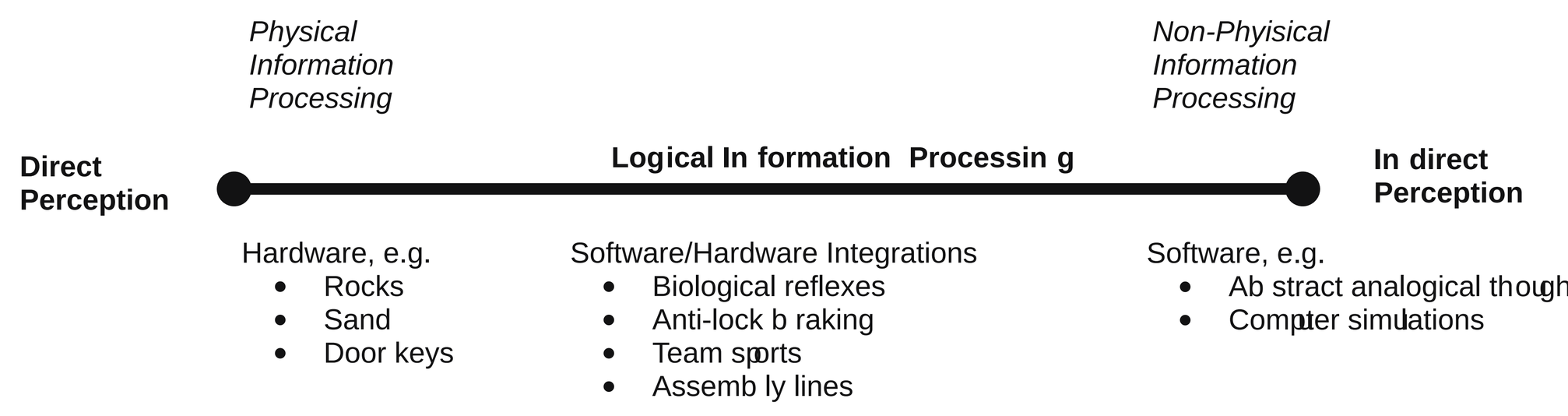

Figure 1: Viewing all physical and non-physical logical information processing as forms of thinking

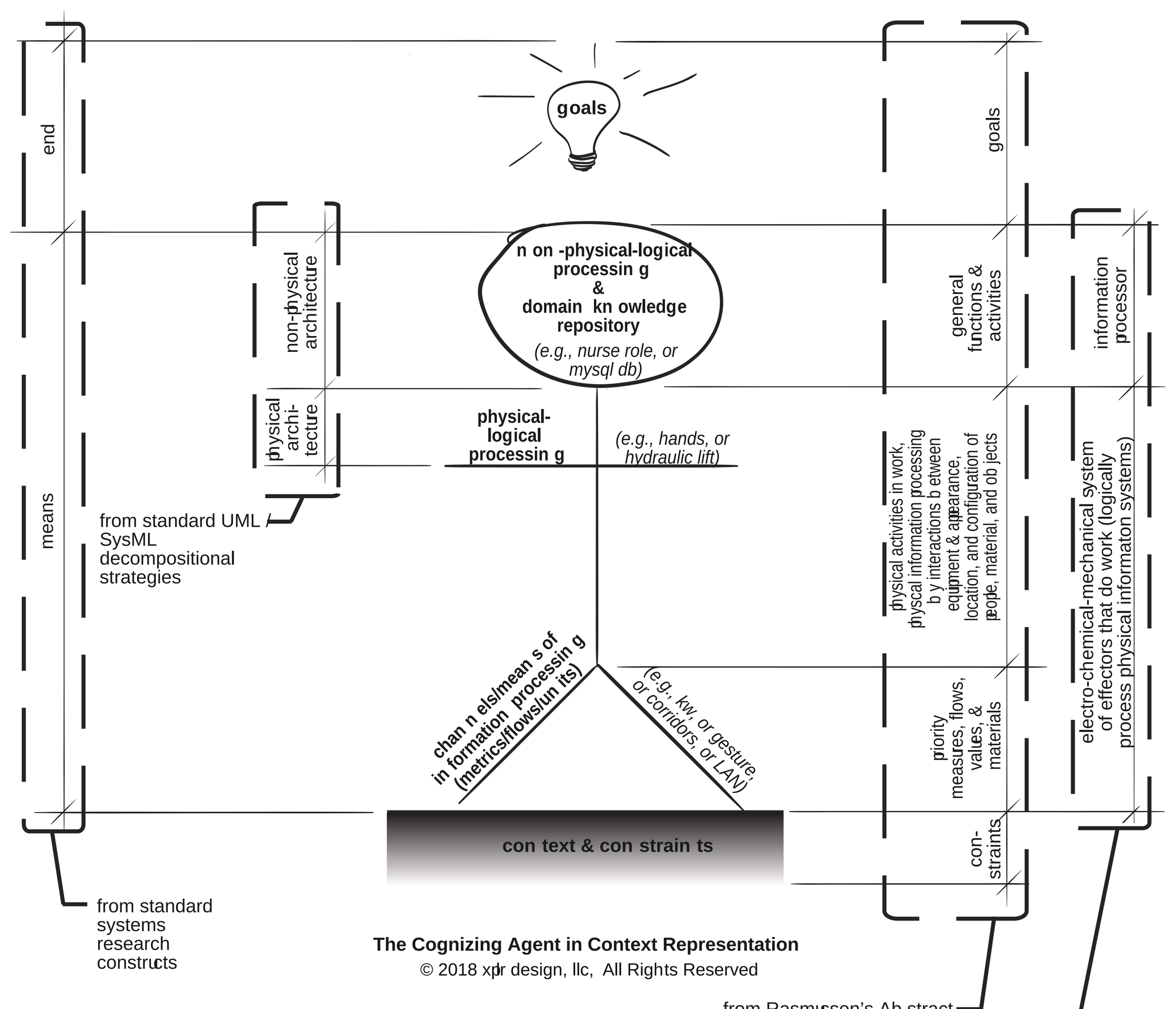

Figure 2: Integrated agent information processing view: Universalizing the Actor Representation --- All processing, physical and non-physical, is logical and is cognition.

Likely Use Cases

Likely use cases entail activities that have well-defined roles performing well-defined tasks through well-defined work processes in well-defined environment and tool ecosystems, including: military, healthcare, some educational environments, and industrial environments. Environments that entail poorly understood roles and tasks and environments would require additional work in order to implement the Agent Architecture Interaction Assessment Framework. This makes this Framework a useful litmus test for use of deep learning for process optimization.

Strengths & Weaknesses

The strengths of the Agent Architecture Interaction Assessment Framework are that it makes visible to the designer the relationships between the environments and tools being designed and the roles, sensory perception, cognition, task performance, and well-being of individuals and groups. The weaknesses of the Agent Architecture Interaction Assessment Framework are that it is labor-intensive and requires adequate access to information about the roles and tasks to be performed in an environment.

Next Steps

The next step is to develop tools based upon this framework and test the efficacy of the tools through case study analyses.

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WHAT IS NEURO-URBANISM?

An article published in a 2017 issue of The Lancet: Psychiatry journal introduces '**neurourbanism**' as "*a new discipline" that "aims to investigate the effect of built and social environments of cities on mental health, and ultimately on the brain", and as such, "must focus on the* ***interdependencies between urbanisation and mental wellbeing*** *with the aim to offer planning and health disciplines the necessary knowledge and tools to meet these challenges."* While the term may be relatively new, the intent is not: environmental psychology, public health, and universal design can also be considered in a like-minded interdisciplinary cohort, interested in understanding **urbanism — increasingly, the prevailing human habitat** — and its relationship to the brain.

And while the premise may be familiar, the tools and technologies available to equip the discipline are relatively new. Advances in data processing speeds, efficiencies and storage have allowed **unprecedented capture of the brain's activity**, and wearable technologies have become cheaper and more readily available. And communities like those attending ANFA conferences are keen on **encouraging collaboration between those in the brain sciences and those who create the built environment.**

Some organizations are already putting that hope into practice, but **how? And to what end?**

CONCERNS

How are practitioners working to merge design/planning methodologies with studies in the brain sciences? How are architecture and planning firms approaching the difficult task of creating a new methodology of urbanistic practice, and what do they hope to get out of it?

METHODS

Over the past few months, I performed cursory research on over a dozen organizations that publicly identified with work that could be seen as "neurourbanistic", mostly within the realms of architecture firms and psychology labs. My questioning was focused on understanding 1) the methods these practitioners used to craft their interdisciplinary practice, and 2) their normative view for why they chose this approach. I then conducted casual, exploratory interviews with eight organizations, as of August, 2018. This initial phase of my qualitative research was meant to be informal, as I wasn't sure how many practitioners would even identify with the term "neurourbanism", or its premises. I plan to continue refining this research throughout the next year, as part of thesis research for my master of city planning at MIT.

My questions revolved around the following:

INSPIRATION:
What kinds of research is the entity interested in?
Who sets the intention of the research?
Do you see your work as part of of larger neurourbanist genre?

DESIGN:
How are the studies operationalized?
What staff is on hand to help?
What tech is available to use?
What literature is being cited?

DIGESTING:
Do the findings become public information?
How is it integrated into your practice?
What areas do you think need improvement?

IMPACTS:
Impacts on urbanism: both idealistic and pessimistic?
Insights into architecture/planning?
Ethical/humanistic implications?

EMERGENT THEMES

HEALTH
- Hippocratic imperative of building science
- Urban as "natural" human environment

GOVERNANCE
- Building infrastructures = public health issue
- Ethical imperative of government to address brian impacts

DISCIPLINE
- Urbanism needs experimental rigor
- Enrich evidence-based & universal design
- Scientists and designers in collaboration
- New tactics in agent-based network analysis
- Human "performance" measurements lack experimental rigor in building science

"In this playbook we use neuroscience research for three types of outcomes. The first is to increase knowledge of well-known environmental stressors, to understand their effects both on our physiological and cognitive development. Secondly, we discuss the potential of new tools to measure the brain activity in relation to the built environment. Finally, neuroscience is used as a biological lens to examine well-known metrics and guide recommendations in relation to physical comforts."

- The Centric Lab, responsible for the "Neuroscience for Cities" playbook for Future Cities Catapult. London, UK.

"I have seen buildings and cities change on the basis of the application of neuroscience to architecture. Think about the fact that chronic diseases are some of the leading causes of disability and death in our entire globe, look at the World Health Organization data and CDC data. Those are environments causing impacts on human beings. When we change those buildings we change those statistics."

- Eve Edelstein: M.Arch., Ph.D. (Neuroscience). Research Director, Human Experience Neuro-Architecture Lab at Perkins + Will, San Francisco, CA.

"There's no systemicity in how people measure performance. So that's what we're trying to do in the lab, put forward measures that have been validated, that we believe would be good standards for the [building science] field."

- Anja Jamrozik, Ph.D. (Behavioral Scientist). Well Living Lab, Minneapolis MN.

"We've been looking at how [London black cab drivers'] patterns of recall relate to the structure of the streets, drawing on the space syntax data and a lot of GIS data and computational modeling. Given that street structure, what will be the demands on their brain to imagine their journey through space?"

-Hugo Spiers: PhD (Neuroscience). Director of the Spatial Cognition Laboratory at University College London, UK.

"I think MIT and Google ought to build a city. They should, build a new one, we've got a lot of space in this country. Build one. And make it a test site, and continually test, to be able to utilize that to design the spaces themselves, and do it just the same way we test for a drug."

- John Medina: developmental molecular biologist, consultant to NBBJ. Affiliate Professor of Bioengineering at the University of Washington School of Medicine.

ROADBLOCKS

- Proprietary concerns
- Scarcity of real-world examples for completed projects
- Different roles within the procedural chain
- Hard to compare across disciplines/jobs
- Limited resources to one interview per institution
- Undefined community
- Ongoing experimental approach
- Diverse technological approach
- Behavioral / neuroscientific indicators
- Limited access to policy instigators

FUTURE PROVOCATIONS

Are there existing policy initiatives for neurourbanism?

Are there emergent neurourbanism design standards?

Critical opinion of those within brain sciences?

How might urbanists best access neurourbanistic research?

How does this research become standard business practice?

Is there an emerginc code of ethics?

BE IN TOUCH!

Know of anyone involved with "neurourbanism"? Let me know!

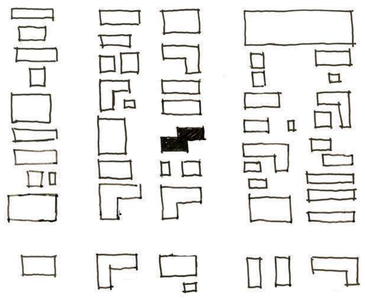
Amelia Taylor-Hochberg
ameliath@mit.edu

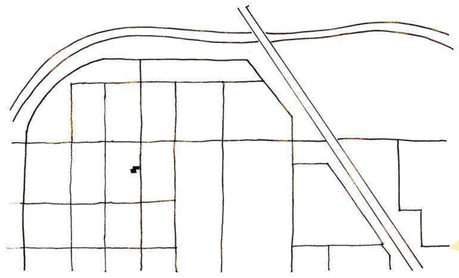
Contemplating Temporal Architecture

Academy of Neuroscience for Architecture
Conference: La Jolla CA
September 2018

Toward better buildings and deeper neuroscientific study of architectural experience and perception

Alissa D. Rupp, FAIA, LEED BD+C
Principal, MIG | Portico
Seattle, WA



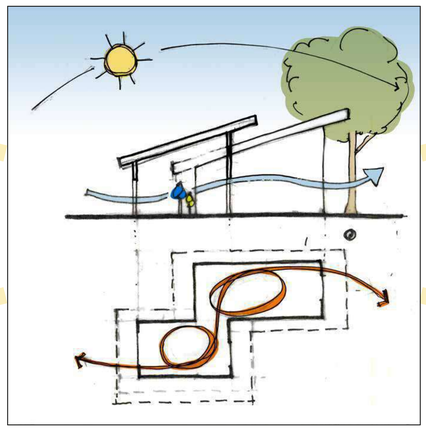


The premise for this presentation is that meaningful perception of architecture requires the perception of time. The relationship between architecture and cognition or perception [neuroscience] may be studied through the lens of our experience of space over time.

Place-based architecture is said to be sensitive to, and reflective of, its place in the world; ideally, the building's site, climate, inhabitants, natural history, and cultural and built contexts contribute to the quality of a built space. The "big idea" for a building must emerge from the context in which the building will live its life, and can only be evaluated against an assessment of whether it affects and improves the user's experience of the place.

When we think of what makes good place-based design, particularly in the modern era of sustainability, aesthetic beauty, and design for health, we think of factors that define a space and its physical nature. Inhabitants of such a building will have access to:

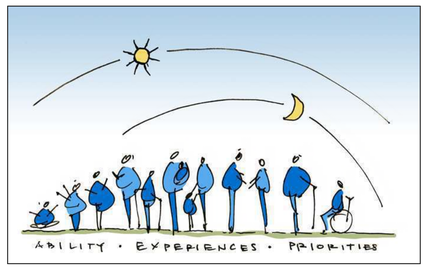
- [Natural] Light
- [Fresh] Air
- Richness, relevant to the cultural, natural or historical context
- Affordances (for the appropriate or expected activities)
- Materials (appropriate to the use and longevity of the building)
- Choice and Control
- Prospect and Refuge
- Privacy and Sociability
- Access to nature and/or connections to the outdoors



Tied to the idea of place is the question of whether a building is suitably designed to be understood over time: how it accounts for our experience of the day, the season, the year, the era in which we encounter it; how it accounts for our movement through and around it; how it accommodates the internal and external changes that will affect its use and longevity. In this context, the "big idea" underlays the lived experience; it affords people collecting, connecting, contemplating, comprehending. That lived experience is not photographic. It occurs over time.

If we consider factors that allow for change over time we may then expand the list of qualitative assessments of the space, and find new ways to evaluate occupants' experiences. To be grounded in and reflective of its time, a building should allow and account for:

- Light cycles – in use of natural and artificial light
- Temperature (diurnal, seasonal)
- Air Flow
- Growing / aging inhabitants
- Growing / aging landscape
- Emergent trends in technology,aesthetics
- Local sounds and acoustics – from inside and outside
- Natural cycles – diurnal, seasonal, annual, epochal
- Social cycles – living things gathering, interacting, encountering each other
- Ceremonial cycles – calendar of regular events



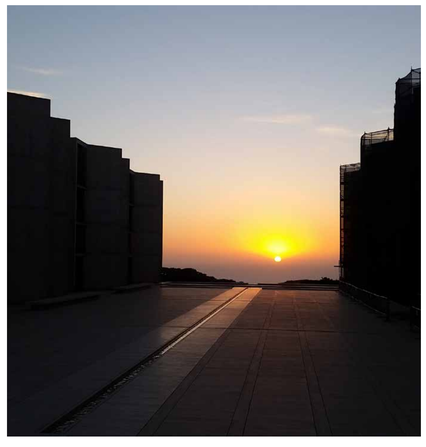
Human understanding of architectural space considers both place and time, and we may be able to improve design outcomes by accounting for how humans perceive and report on the passage of time. We therefore need to consider the ability of the built environment to absorb and reflect change. Time and change are inextricable from each other, so architecture that accounts for both place and time (change) must be temporal architecture.

All users of the built environment will grow, gain experiences, and have different needs depending on age, activity and mood. Accurate perception and relevant use of architectural space require movement, which is a kinesthetic human experience in real space and real time. Spaces and features are not all perceived in an instant, which suggests that some aspects are hidden – or at least revealed over time. Durations vary; such perception may require the passage of seconds, or hours, or decades. If our buildings are to reflect time, or afford change, then their materiality matters, and the organization of their spaces matters. Materiality and programmatic organization can facilitate an emerging understanding of a space; just as they allow us to be grounded to place, they may allow us to be aware of, and responsive to, time.

Time passes, which is made evident for humans through pattern, movement, narrative and change. Taken together, these time-based factors might be called FLOW. If acknowledgement of PLACE is the way that SPACE is made to be relevant, and given qualities that encourage humans to develop and thrive, then FLOW is the way that TIME can be acknowledged and accommodated in the built environment.

PLACE • FLOW
SPACE • TIME

Studies that ask subjects to estimate how much time has passed in a real or virtual environment are particularly interesting if a misperception of time (longer or shorter than actual clock time elapsed) is an indicator of something happening in the brain. Time and space are relative; our perception of them is related to our own activity, primed state, and recent experiences in space and time. We may be able to study whether our ability to perceive (or extend or shorten) a sense of time passing is essential to our individual perception of space. How does our unique human ability to anticipate and contemplate the future, and to imagine possible



"The pleasure of architectural experiences – the phenomena of light and spatial sequence, textures, smells and sounds – is irreducible and ultimately enmeshed with situation, season and time of day..."

—Steven Holl

Humans have divided time into intervals, and we attach different significance to those intervals depending on the context. Sometimes milliseconds are the relevant interval, while sometimes the passage of eons is the only way to perceive significant change. If we are "in the zone" we say that "time flies" or that a particularly satisfying day seemed to last forever. Many have said that in times of extreme stress or duress an event will "slow down" so that they perceive it in minute detail, and that perhaps their entire life "passes before their eyes." As we grow into adulthood, experiencing fewer novel events or less time "in the zone," the years seem to go by more quickly.

Our perceptions of space change as well, depending on the circumstances. Some changes are temporal, some are circumstantial. Our childhood home or garden, seemingly a vast landscape in our young imagination, then seems tiny when we see it as an adult. Our first experience in an awe-inspiring building, as we perceive its size, complexity or beauty, may be very different from the tenth time we encounter it. A room we know well in the daylight may seem unpredictable and frightening as the shadows of darkness descend. Our path on an unfamiliar route will seem longer (in time and distance) than the re-experienced, now-with-landmarks, return trip.

Even accepted models of learning have time built into them, though it may not be explicitly noted. In Thomas Albright's model, learning is what moves us from getting information to keeping it, and the process is parallel to that of information changing from being novel to becoming familiar. The content is not "filed away," rather our brains are changed and we create a memory.

Learning:

Apprehension	Organize	Use	Recall	Retention
[Get it]		[Use it]		[Keep it]
[NOVELTY		toward		FAMILIARITY]

In learning, our memory is modified over time. In the perception of architecture, as we "learn" a space, we make maps – maps that project where we will be in space AND time as we move through space. When we map spaces, we also create strategies for navigating those spaces over time, based on changes we can anticipate. We reflect on, experience, and predict the flow.

As we learn, we understand the "story" of the topic, or space, we are studying. We understand the story of the space – we can talk about it in a narrative. The narrative requires the passage of time – the movement through space, over time. So our environments are changing people. And people are changing their environments, if they can.

If our buildings are changing people, then from where does the capacity of architecture to generate meaning or emotion emerge? How do we keep from trivializing the neuroscience of experience (where we put the desk, how big we make the window) and study the origin of meaning and emotion as it relates to the built environment and our experience of flow within it? How can this study then make our built environment better?

We have learned a great deal about how built spaces can help people learn better, heal faster, express more happiness, and live longer. Can the impact of flow – time, movement, narrative and change – be included in this important course of study? When daylight, views, access to nature and gathering areas are provided in a building, and we document faster healing or an improved learning environment, what can be attributed to the built environment affording a sense of place, and which effects occur because the inhabitants are attuned to the diurnal cycle, or otherwise able to perceive the passage of time? How much reported stress, boredom, sleep disorders and fatigue can be mitigated by temporal awareness and connections? Architects, planners and philosophers agree: connection to the temporal aspects of our buildings and sites can make our experiences richer. How can we further engage neuroscience in development of a temporal architecture?

Ideas: Toward a Temporal Architecture

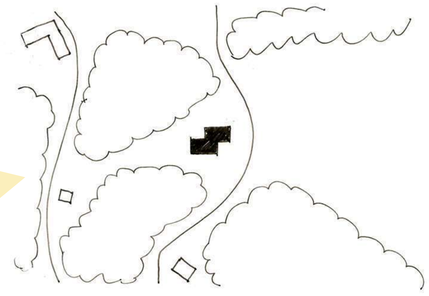
- Attention to thresholds
- Walls and furnishings that move and change easily
- Building shapes that mitigate temperature with seasonal air flow, shade, access to sun
- Attention to directional exposure
- Stairs in small increments, replaceable or interchangeable with ramps
- Connection to nature, to the street, to the context
- Allowing improvisation – engineering, design and use in real time
- Participatory design, construction, use and reuse
- Allowing emergent behaviors and uses
- Sustainable design that will fit over time
- Design for climate change
- Design for cultural change
- Design for technological change
- Avoid "multi-purpose" or "generic" space – acknowledge the time and place of now
- Embrace rhythm, consider pattern and movement
- Use perspective to imply time and layering, and encourage movement

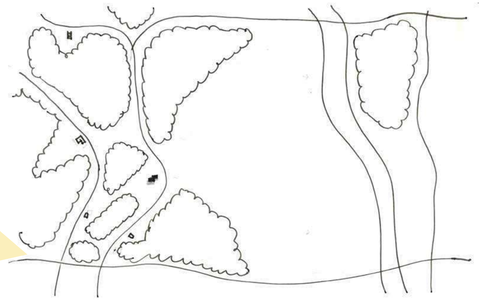
"Placemaking inspires people to collectively reimagine and reinvent public spaces as the heart of every community. Strengthening the connection between people and the places they share, placemaking refers to a collaborative process by which we can shape our public realm in order to maximize shared value. More than just promoting better urban design, placemaking facilitates creative patterns of use, paying particular attention to the physical, cultural, and social identities that define a place and support its ongoing evolution."

—Steve Davies, *Project for Public Spaces, 2018*

"Architecture itself has no time dimension, no movement, and therefore cannot be rhythmic in the same was as music and dancing are. But to experience architecture demands time; it also demands work – though mental, not physical work. The person who hears music or watches dancing does none of the physical work himself but in perceiving the performance he experiences the rhythm of it as though it were in his own body. In much the same way you can experience architecture rhythmically – that is by the process of recreation... If we believe that the object of architecture is to provide a framework for people's lives, then the rooms in our [buildings], and the relation between them, must be determined by the way we will live in them and move through them."

—S. E. Rasmussen, *Experiencing Architecture, 1959*





"In the experience of art, a peculiar exchange takes place; I lend my emotions and associations to the space and the space lends me its aura, which entices and emancipates my perceptions and thoughts. An architectural work is not experienced as a series of isolated retinal pictures, but in its fully integrated material, embodied and spiritual essence. It offers pleasurable shapes and surfaces moulded for the touch of the eye and other senses, but it also incorporates and integrates physical and mental structures, giving our existential experience a strengthened coherence and significance."

—Juhani Pallasmaa, *Touching the World in The Eyes of the Skin*

"It is a complex order. Its essence is intricacy of sidewalk use, bringing with it a constant succession of eyes. This order is all composed of movement and change, and although it is life, not art, we may fancifully call it the art form of the city and liken it to the dance... The ballet of the good city sidewalk never repeats itself from place to place, and in any once place is always replete with new improvisations."

—Jane Jacobs, *The Death and Life of Great American Cities*

"Aalto's firm grasp of the whole has made his buildings so amazingly vital...His buildings are formed around the life to be lived in them."

—Alberto Perez-Gomez

CROSS-DISCIPLINARY QUESTIONS AND TOPICS

- Developmental Neuroaesthetics – Contemplate studying FLOW in young children – how kids get into that flow state, and what affects the amount of time they spend there.
- Contemplative Neuroaesthetics – Art, architecture, spiritual traditions, medical and emotional effects of aesthetic environments. What is really happening in real time?
- Free-choice and informal learning spaces – How to engage and optimize the design for participation and engagement by a diverse and changing/growing audience in museums, visitor centers, gardens? Wayfinding? Screens? Full body experiences?
- How do we quantify the "depth" of thought – In deep thought or contemplation, vision is blocked. We don't see what is in front of us. We compress our visual world.
- How do we quantify awe – Images of buildings that we already "know" are great are not parallel to a full-body experience of a great building. What does it mean to our bodies and brains to move through those spaces in real time?
- Follow on Rusty Gage lecture – If great art is an experiential lived reality AND an imagined memory or fantasy, and if it is a live encounter AND a poetic evocation in internal space and time, and if it is matter and mind, real world and perception, then what if we look at how that happens?
- Does great trauma also exist in both lived experience and imagined memory? Does a given reality take on an imagined significance in our internal understanding of space and time? Are there parallels? Is this true for anything that CHANGES us, since we can re-move through space but we cannot re-move through time?
- Can neuroscientific study help us support the human benefits of flow (attention to place, time, change, narrative and movement) in architectural design?

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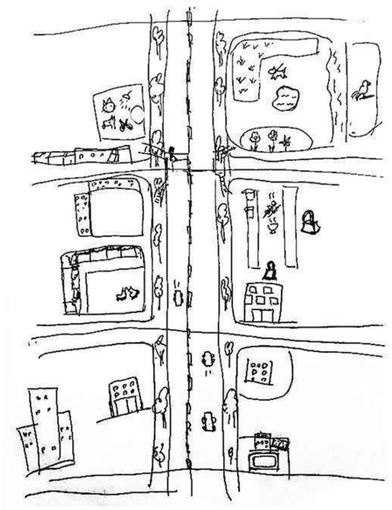
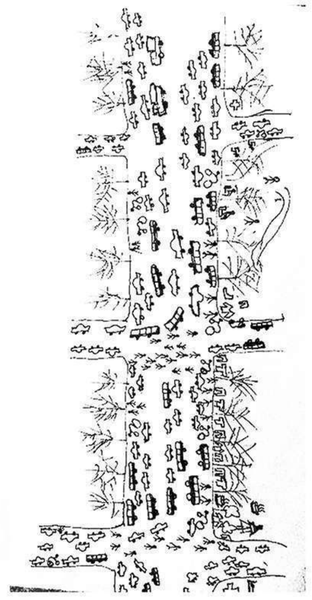
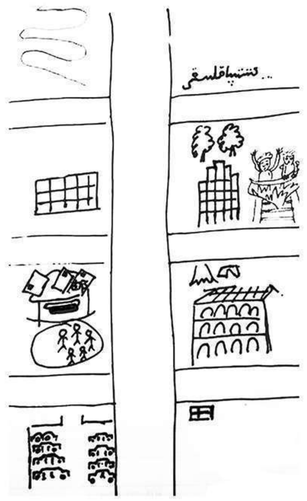
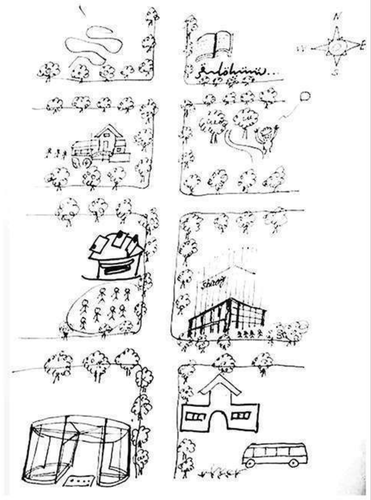




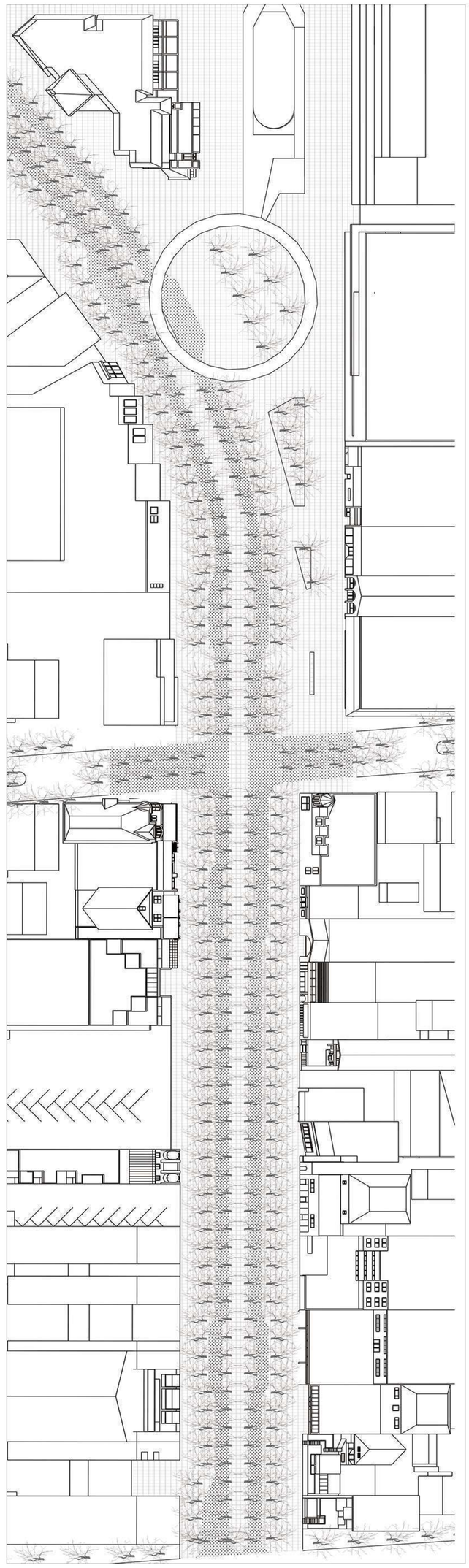




Urban Design with Psychoanalytic Approach

- design guidelines shaped by clinical solutions, a thesis proposal in Berkeley, CA

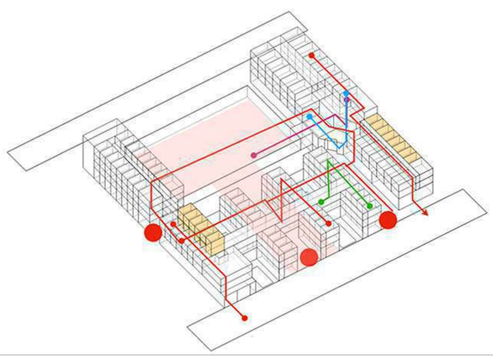
Author: Haonan Lu Urban Designer, Psychologist haonan.lu@berkeley.edu



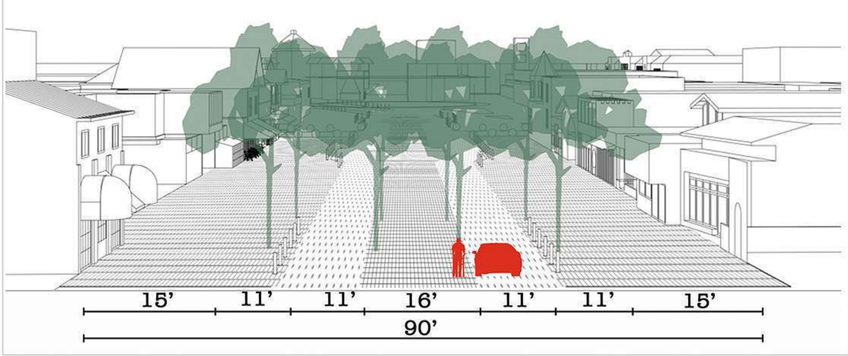
for “self-efficacy” (Bandura, 1977)

for “narcissistic injury” (Kohut, 1971)

for “holding environment” (Winnicott, 1965)



for “working through” the trauma (Freud, 1914)



ANFA 2018

POSTER SESSION #6

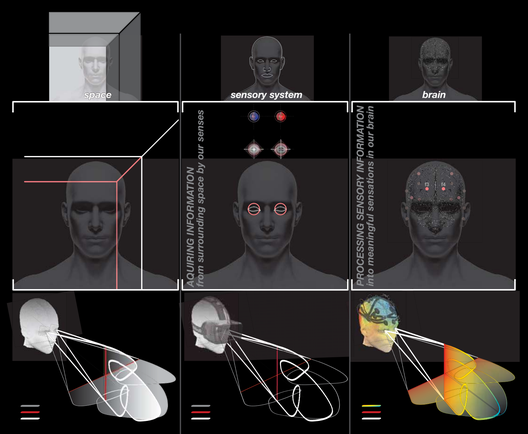
JOHANNA JÕEKALDA

ESTONIAN ACADEMY OF ARTS
VIRTUAL REALITY LAB

SHAPING SPACE BY EXPERIENCE DATA

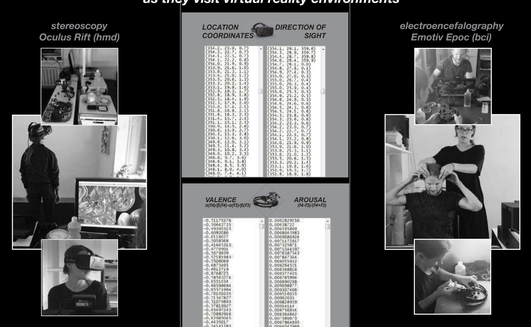
Research Statement

Spatial perception as a cognitive process has become definable in terms of data. The theoretical part of the research examines how the main actors in spatial perception as a cognitive process – space, senses and the brain – have become definable in the language of new media, and how to make use of it while shaping spatial experience. The practical part of the research proposes techniques that allow to extract test subjects' experience data from brain-computer interfaces, galvanic skin response sensors, heart rate sensors as they visit real and virtual environments, and apply this data in the design process.



ANALYZING THE COGNITIVE PROCESS IN TERMS OF DATA
transferring the experience data back to space

EXTRACTING TEST SUBJECTS' EXPERIENCE DATA
as they visit virtual reality environments

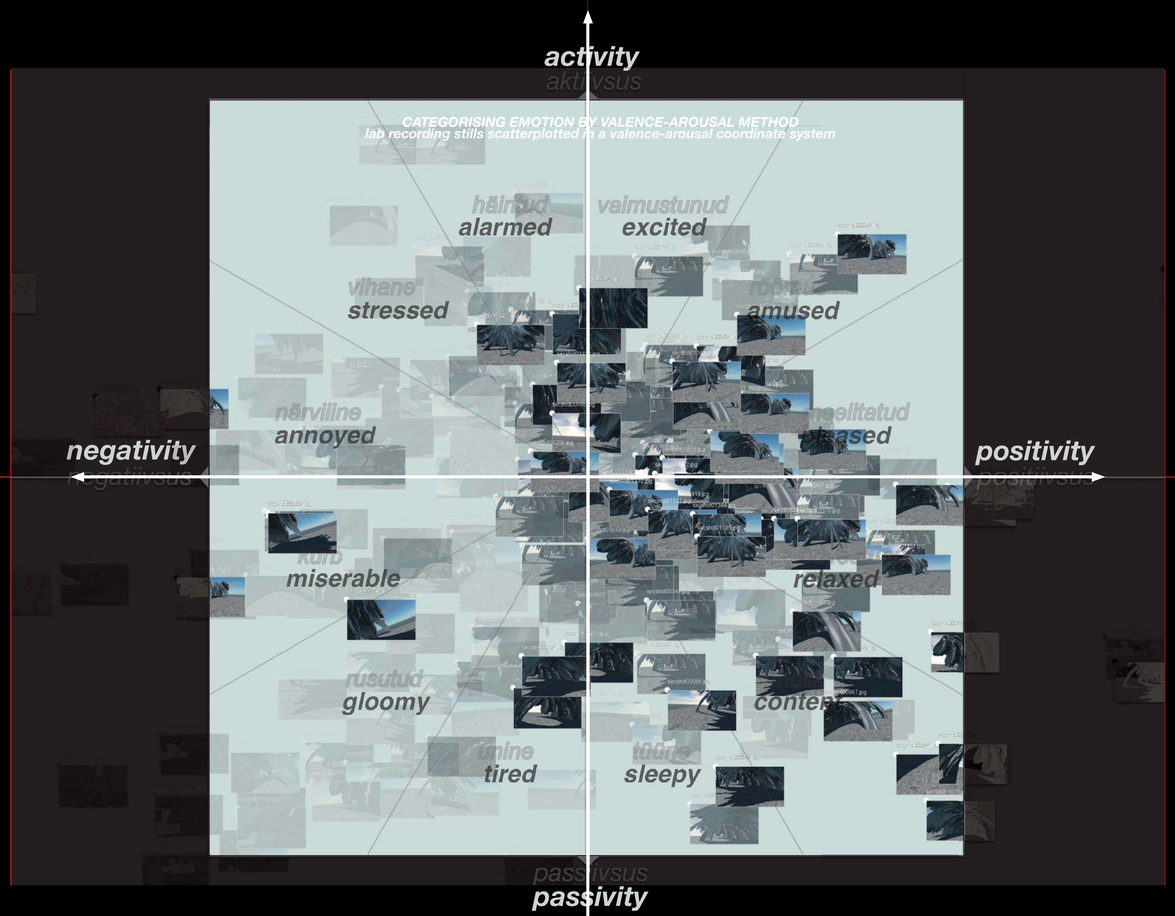


Research method

The project proposes data-based techniques that allow to stimulate users' mental states by adapting the visual properties of space. Space becomes a communicating agent.

Research Question

Cognitive processes are often left out of the equation in data-based decision-making mechanisms as they are not commonly considered definable as data. One such cognitive process is spatial perception through which we use our senses to acquire information about the space around us and process it into meaningful knowledge in our brains.

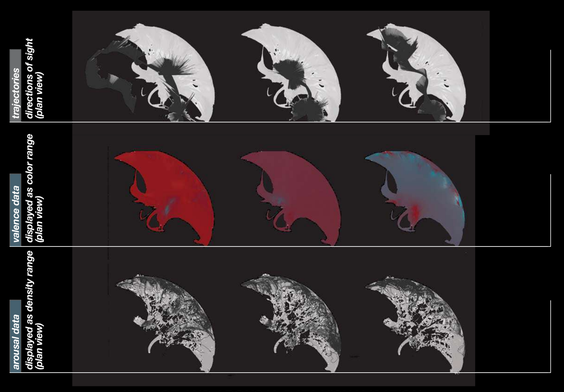


Research method

The indicators of the test subject's emotional states are ascertained by valence-arousal method on the scales of activity-passivity and positivity-negativity.

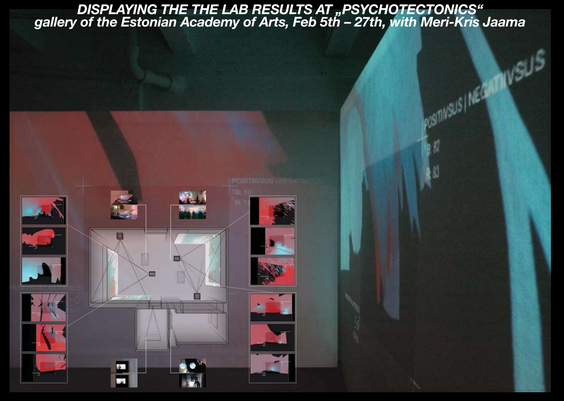
Research Outcome

The potential use of these techniques is illustrated by installation projects that demonstrate how spaces can be programmed to adjust according to the visitors' experience data. The principles for the adaptation of the spaces are based on various illusion techniques that allow the ostensible properties of the environment to be distorted in a data-based manner. The boundary situations and adaptation logic are designed by the architect, while the user shapes the situation at a given moment in time. This results in an experience-charged space that recognizes the beholders' spatial experiences and adapts itself accordingly.

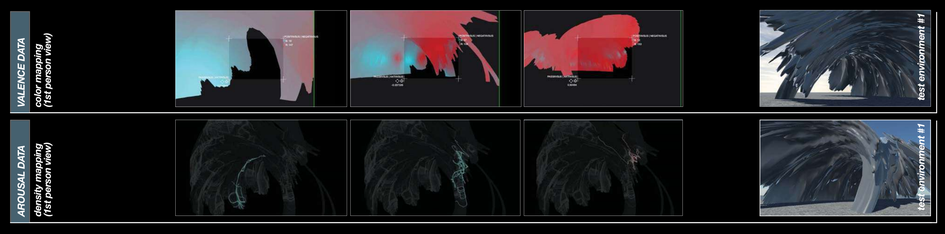


VALENCE AND AROUSAL DATA VISUALISATION
3d model of the test environment

DISPLAYING THE THE LAB RESULTS AT „PSYCHOTECTONICS"
gallery of the Estonian Academy of Arts, Feb 5th – 27th, with Meri-Kris Jaama



The data is analyzed by post-scientific methods that allow to enter the indicators into spatial models and manipulate their formal properties on the basis of these data.



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Acknowledgements

Meri-Kris Jaama, Indrek Jõgi
PhD Renee Puusepp, Martin Melioranski
PhD Lev Manovich, Ilya Kuzovkin

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The Biological Effects of Materials: Visual and Tactile Perception of Environment

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"It is in the very nature of science that it succeeds by focusing on ***parts of the whole****. The challenge is to determine which the 'right' parts are, and how lessons gained from* ***the study of separated parts*** *may provide* ***a firm basis for study of the larger system*** *formed when the parts are combined."*

M.A. Arbib (2013)

WHAT'S THE BIG IDEA?

This is a PROPOSED experiment which seeks to understand the impact of materials on the human body and how it molds our relationship with the built environment. We hope to inspire others to execute a similar protocol.

VIRTUAL REALITY would be the platform from which this experiment would be built. There would be a controlled path of travel through a series of "rooms" which would each feature a different category of materials.

PHYSICAL SAMPLES would be used in congruence with the virtual experience, allowing users to "touch" the simulated surfaces of the virtual environment.

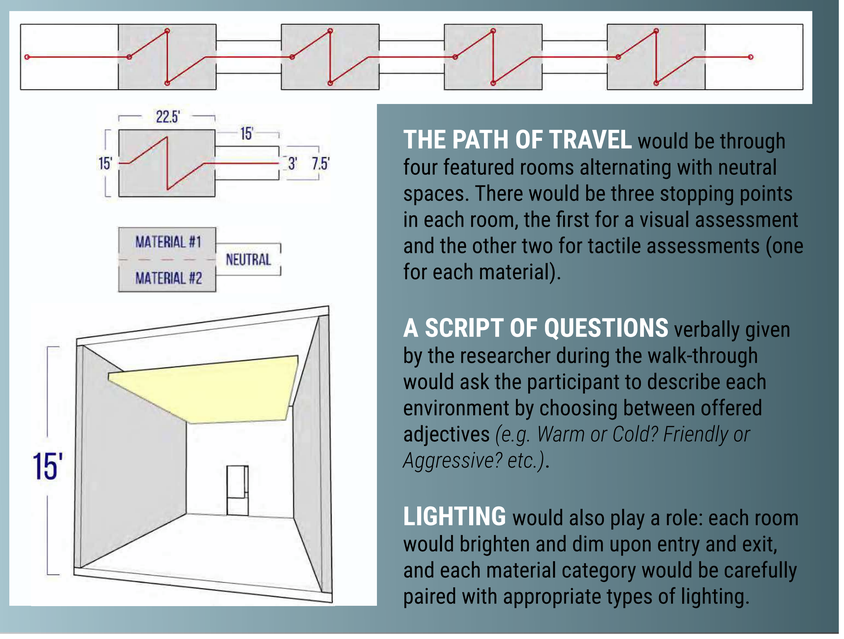
GSR, FMRI, and/or **HEART RATE** would be monitored and recorded for the duration of the experiment.

NATURAL: a category of materials suggesting a more raw, "earthy" origin; an outdoor environment.

MIXED: a category containing materials which suggest the human gestures of a craftsman.

MANUFACTURED: a category of "processed" materials which suggest an artificial origin.

GARISH: a category of materials with intentionally "ugly" choices of color and pattern, chosen with the intention to provoke a negative response for means of data comparison.



THE PATH OF TRAVEL would be through four featured rooms alternating with neutral spaces. There would be three stopping points in each room, the first for a visual assessment and the other two for tactile assessments (one for each material).

A SCRIPT OF QUESTIONS verbally given by the researcher during the walk-through would ask the participant to describe each environment by choosing between offered adjectives *(e.g. Warm or Cold? Friendly or Aggressive? etc.)*.

LIGHTING would also play a role: each room would brighten and dim upon entry and exit, and each material category would be carefully paired with appropriate types of lighting.

ABSTRACT

Responding to Dr. Arbib's challenge, which is the ANFA's desire for the vital exchange between architects and neuroscientists, this poster presents a protocol of a possible experiment which investigates how MATERIALS biologically affect the individual (i.e. heart rate, galvanic skin response, etc.). We propose that just as various environments have distinct impacts on man, so do various materials leave a measurable imprint as they are experienced through vision and touch. To understand this would be to better understand how we experience architecture—for, to paraphrase Harry Mallgrave, architecture is nothing if not materials touching.

Since many variables can influence our spatial experiences[i] we must examine material because it is the most common variable. Indeed, it takes more than "thingness" to define environment because the power of suggestion can play a larger role; a Berkley study[ii] explored the effects of workspace dividers and discovered that office employees found the symbology of their environment to be more important than physical considerations. Material can be bold or subtle in its physical and suggestive abilities as it precipitates form, interacts with light, and creates color. Therefore, it is reasonable to surmise that material perception (that is, our understanding of the origin or composition of materials[iii]) can influence our bodily experience and perception of environment.

Various studies have explored some aspects of materiality. "The Physiological effects of Shinrin-yoku"[iv] entailed biofeedback experiments demonstrating that a natural environment (a forest) was more physiologically relaxing than an urban cityscape. Students at the Tokyo Institute of Technology[v] created a virtual walk-through among high-rise buildings to understand how different architectural treatments could help reduce feelings of oppression. "Touching Materials Visually"[vi] revealed that tactile assessments of material samples could significantly alter perceptions gathered from visual assessments. Each study suggests a different potential of material's influence, but we are proposing a new, all-encompassing procedure. We propose an experiment that would include various categories of materials, each category within its own virtual environment which the seated participant would evaluate through verbal description, vision, and touch. In the latter case he would be asked to reach out and "touch" a virtual wall while a research assistant held up a correlating physical material sample, providing the participant with the illusion of touching a "real" surface within the virtual simulation. Biofeedback monitoring could be used in combination with functional Magnetic Resonance Imaging (fMRI) to evaluate the potential for embodied simulation in visuotactile mirroring mechanisms.

Our expectation is that an experiment of this caliber could reveal the biological impact of material on Man and his spatial experience in a way which has not been previously done, and therefore could have some powerful ramifications on how we approach architectural design in the future.

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