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Translational Science Model for Designing of Outdoor Environments for Stress Relief in an Educational Institute

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ABSTRACT:Throughout history outdoor landscapes have been proven to be effective at stress relief . Unfortunately in the 20th century ,with the advent of industrialization and technology, the connection between man and the natural environment has come under increasing strain.But now architects and other educational communities are again trying to restore this balance by inducing nature into the contemporary built environments through landscape design.In a developing country like India, the design of outdoor environments and elements is primarily done on the basic intuitive and design skills of architects or designers. They are seldom aware of the impact of various environmental and physical factors on the physiology and neurology of the users ,the primary consideration being that the space should be looking aesthetically appealing to the client, also there is very little knowledge on the quality of these factors that may provide the most beneficial effect in context of stress relief.

Latest innovations and research in the fields of neuroscience, medicine and other allied fields has led to a broader level of understanding about the characteristic features of various environmental and physical factors ,and their implications on human psychology and immunology ,also it can help to evolve a set of quantitative and qualitative attributes for these factors that can help design environments that are convergent to stress relief .This paper aims to discuss and develop a translational model that can converge the use of existing subjective theories based on evidences from clinical and behavioral sciences and the neurological implications of the environmental and physical factors for designing an outdoor environment for stress relief .The proposed model would help to analyze and test existing design features and elements in an outdoor environment in context of stress relief .It can help to access weather the characteristic features of these factors are qualitatively and quantitatively suitable for stress relief .
To understand the suitability of these design features and factors in context of a space ,a survey is conducted with the students of architecture from School of Planning and Architecture ,Bhopal to access their stress levels and their preference of environmental and physical factors .This evidence plays an explicit role in determining the suitability of the design features and elements for the stress relieving spaces in an institute.

KEYWORDS: Immunology ,Neuroscience ,Psychology and Translational Model.

I. INTRODUCTION

Historically, behavioural and psychological studies has focussed on the impacts of the physical environment on human responses, and proffered suggestions on how design could be adapted to people's needs. Technological developments provided the means to measure human physiology and ergonomic analysis of the interaction between body and form. Now, a new layer of knowledge can be applied by using the instruments recently developed in neuroscience in order to understand how the brain perceives outdoor environment and landscapes, and how it responds to place.

Today, environmental studies have showed how environments affect people. And architects, whowere once primarily concerned with how designed spaces looked, now have to consider howthey will affect the people who use them. Principles of crowding, privacy, personalspace, and environmental perception, environmental factors such as noise, temperature, color ,light and smell and physical factors such as patterns and forms may all determine how an outdoor environment is designed and how well it servesits function.

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A cross-sectional study conducted to assess what elements of the physical environment are significantly linked to mental health showed that access to green space was an important predictor of mental health status and vitality, regardless of socio-economic status, age and sex [Guite, H. 2006] .

The concept of outdoor environment as healing spaces has been discovered and used since a long time but its primary focus had been on designing healing environments for hospital settings .This paper validates and implores the use of contemplative spaces in an institutional setting and presents a translational model that can be used as a tool to access the suitability of various design features and elements as stress relieving in an outdoor environment for an educational institute The first part of the paper summarizes the neurological implications of various outdoor environment and physical conditions like light, colour, nature, forms, patterns and sounds that can potentially cause and mitigate stress .These factors have been studied because they can be altered by the architect to design a setting that fits the purpose .The second part of the paper discusses the existing principles and theories on stress relief through the use of outdoor settings. The third depicts the results of the surveys conducted among the architecture students ,to access their needs for stress relief and what features or settings are preferable .This information is the primary clinical evidence and it is subsequently used as an input for the model . The fourth part describes the proposed translational model and its various aspects in depth ,the final part of paper presents the discussions ,limitations and prospects for future researches regarding the translational model and its parameters .

II. METHODOLOGY

First, an extensive literature review was conducted to provide background information on both stress relieving spaces and the environmental factors for stress relief. This literature review includes research on nature-viewing and stress reduction, published work on design of outdoor spaces, design of healing spaces and works on environmental stressors and factors for stress reduction .

The second part of our approach was to conduct a systematized set of three surveys among the students of School of Planning and Architecture , Bhopal with primary intentions of:
1. Accessing their stress levels to justify the use of a contemplative or restorative space in an educational institute .
2. Accessing their biophilic tendencies to find out what kind of spaces would be most apt for stress relief .
3. To derive contextual understanding about the qualitative and quantitative attributes of the environmental and physical factors that can be used as clinical evidences and subsequently used as primary information in the translational model proposed in the coming chapters of the research .

Based on the information gathered from secondary sources in the previous parts of the research the importance and utility of a stress relieving space in an educational institute is established also the use of outdoor spaces for stress relief is also justified .

The following part of the paper presents a conceptual translational model that uses neurological (secondary sources) ,subjective and clinical (primary findings) evidences to determine the suitability of design elements or attributes in context of stress relief in an outdoor environment.
The various components of the model are explained and questions related to its context and method of application are discussed at length .Further the framing of the hypothesis or questions that will render the result in the model are explained .In the final part of the paper the limitations of the model and the scope for future research are discussed .

III. BACKGROUND

Types of healing spaces

The attempts by experts in the field to introduce nature into healthcare settings have been variously described as contemplative gardens, restorativegardens, healing gardens, and therapeutic gardens. *Contemplative* gardens are usually intended to mend the spirit. In *Restorative Gardens*, Nancy Gerlach-Spriggs,describes *restorative* gardens as places meant for the healthy as well as the sick. “For thehealthy, such gardens encourage sociability among companions, promote relaxation andcontemplation for the solitary visitor, or create a sense of community among residentswho live in quarters around the garden. For the sick of body or troubled in spirit, thesame garden relaxes and soothes and thereby

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encourages the body and the mind to restorethemselves" [Gerlach-Spriggs ,1998]. According to Roger S. Ulrich, "a *healing*garden refers to a variety of garden features that have in common a consistent tendency tofoster restoration from stress and have other positive influences on patients, visitors, and staff or caregivers" [Marcus, Clare Cooper and Marni Barnes. 1995] .The term "therapeutic", however,suggests more than comfort, according to Gerlach-Spriggs. It implies that the individualwill be working toward a goal or outcome. For example, there may be ramps, smallcurbs, or varied surfaces designed into the environment for the patient (with theassistance of the occupational therapist) to master with a wheelchair, or there may be asmall planting garden to improve fine motor skills. In the context of an educational institute the typology of the outdoor stress relieving environment would share many attributes of the restorative and contemplative gardens.

Neuro-architecture

Earlier it was believed that our brain stops developing new neurons when we are in ourtwenties. In 1998, Fred H. Gage (Salk Institute for Biological Studies) and Peter Eriksson (SahlgrenskaUniversity Hospital) discovered and announced that the human brain produces new nerve cells inadulthood. Our brain is formed in the 3rd month of pregnancy, and after that grows remodelled byenvironments we are surrounded with. Neuroscience explains the connection betweenenvironment and behaviours; from perception to impulse transportation and how neurons built upand store information in our brains [Sternberg & Wilson ,2006] . When we learn all we 'think' and 'feel' are formed by our brain and nervous system, we realize the importance of our unique perception and impact of environments. In order to understand the relation between neuroscience and architecture, we can start with our basic activities that we use our five senses to perceive the environments. Perception also involves with our navigation in space, and neuroscience explains on how physical environment affects our cognition, problem solving ability and moods. Understanding these principles can guide architects to design built environment serving better spatial orientation, reinforcing cognitive abilities and minimizing negative effect in emotions and motivation[Eberhard ,2008][Stein & Stoodley ,2006] .

Environmental and Physical Stressors in an Outdoor Environment

Stressors that are found in our surroundings are called **environmental stressors**. Everyday life is full of environmental stressors that cause minor irritations. Our outdoor environments are surrounded by numerous stressors like:

- Noise
- Colors
- Extremely bright/dull Lights
- Heat
- Odor

Also there are physical factors and elements that are part of the natural environment or the design outcomes that can act as stressors. They primarily include:

- Forms
- Patterns
- Natural landscape

Recent research has linked extreme temperatures, colors, light and noise with increased levels of discomfort and aggression. Different colors can raise or lower your stress levels. For example, green is often associated with life and growth and is known to reduce tension and anxiety. Exposure to light can improve your mood and decrease fatigue, while prolonged exposure to darkness can interfere with sleep patterns and lead to symptoms of depression.

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IV. LITERATURE STUDY

EXISTING THEORIES ON DESIGN OF RESTORATIVE SPACES

The Biophilia Hypothesis

Research from many quarters, including the fields of healthcare, psychology, design, public health, and other disciplines indicates that access to nature can enhance health and wellness. Annerstedt and Wahrborg (2011) propose three main kinds of public health effects related to nature: short-term recovery from stress or mental fatigue, faster physical recovery from illness, and long-term overall improvement on health and well-being .Wilson (1984) addressed the premise for using contact with nature in the treatment of diseases more than twenty-five years ago with his biophiliahypothesis.

Short-term recovery from stress or mental fatigue has been well-studied. Studies agree that nature views are more effective in reducing psychological and physiological stress than urban views, and lead to more positive feelings in subjects [Hartig ,Evans , ,Jamner ,Davis & Garling ,2003][Ulrich ,Simons ,Losito ,Fiorito ,Miles & Zelson ,1991].In this statistically rigorous study, residents reported less stress and increased physical activity levels in neighborhoods where vacant lots were turned to community garden spaces .Long-term overall benefits of contact with nature for large population groups were explained by Wilson's biophilia hypothesis.

The biophilia hypothesis suggests that there is an instinctive bond between human beings and other living systems. Infurther exploration of this concept, Stephen Kellert (2008) investigated the idea of biophilic design, which he defined asthe "deliberate attempt to translate an understanding of the inherent human affinity to affiliate with natural systems andprocesses into the built environment." He noted that people living in proximity to open spaces report fewer health andsocial problems, and that even the presence of grass and a few trees has been correlated with enhanced coping andadaptive behavior. Individual conditions are ameliorated by contact with nature, but benefits translate to the greatercommunity as well. Communities with higher-quality environments report more positive valuations of nature, superior quality of life, greater neighborliness, and a stronger sense of place than communities of lower environmental quality. These findings were found to apply in poor urban as well as more affluent and suburban neighborhoods.

Biophilic designs are based on six elements or attributes.
These designs generally include:

- Environmental features
- Natural shapes and forms
- Natural patterns and processes
- Light and space
- Place-based relationships, and
- Evolved human-nature relationships.

Ulrich's Theory of Restorative Design

Dr. Roger Ulrich's (1999) theory of restorative garden design is based on theory and research in the behavioral sciences and
health-related fields. His theory proposes that gardens in healthcare situations are important stress mitigating resources for patients and staff because they foster:

 Social support
 Sense of control
 Physical movement and exercise
 Access to nature and other positive distractions

Research-based evidence exists to show that each of the four restorative components mentioned above can reduce stress and thereby improve other health outcomes. It must be noted that gardens at healthcare facilities serve a wider population group than the patients / residents. In context of hospital settings families and visitors, as well as staff, are also important users of these outdoor spaces. An engaging garden can provide a venue for activity, topics of conversation, and memory cues for both visitors and patients. These garden features can enhance the quality of the visit, which in turn enhances health outcomes for the patient and brings visitors back more frequently. Staff are another

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important user group for outdoor spaces at healthcare facilities. Staffoften have stressful jobs and frequently have no place to go for a break. Garden spaces can provide a sorely needed escape from the pressures of the job.

NATURE OF HEALING SPACES IN AN EDUCATIONAL INSTITUTE

As mentioned earlier college students experience stress due to a number of possible factors .The competitive environments and education system has led to the creation of such kind of work environments .Although they have become a necessity in modern day world but its ill effects can be dealt in a very subtle way by harnessing the potential of outdoor landscapes and using them as healers of mind, body and spirit .

Ragsdale, Beehr, Grebner and Han (2011) hypothesized that students experience a period of stress during the week and a period of recovery over the weekend. Three types of recovery activities were addressed: physical activities, social activities, and low-energy activities such as reading a book or watching a movie. Students find these types of activities enjoyable because they help the students to maintain equilibrium of stress and relaxation. Physical activities keep the student's body healthy, social activities give the students a feeling of support, and low-energy activities provide the student with rest. Undergraduates from a small Midwestern university were tested on their well-being after a weekend of recovery activities. Students who engaged in more weekend recovery activities than students who used weekends to perform stressful tasks such as homework reported better well-being on Mondays.
Thus it can be safely deduced that an contemplative or restorative space designed of an educational institute must provide an opportunity for promoting these kind of activities .Further more in an educational institute the user group also includes the faculty and staff they also have stressful jobs and such spaces can provide contemplative and restorative effects for them.

STUDY OF ENVIRONMENTAL AND PHYSICAL FACTORS OF AN OUTDOOR ENVIRONMENT AND THEIR NEUROLOGICAL IMPLICATIONS

To design a stress relieving outdoor environment firstly the stress causing elements/stressors have to be studied at depth .Their neurological impact is documented in numerous scientific experiments also based on the neurological and behavioural evidences their optimal range or conditions are presented .Also the physical factors such as forms and patterns which are not classified as environmental stressors but may provide significant neurological nourishment and subsequent stress relief are discussed in detail .Based on environmental design literature study ,scientific experiments and biophilia hypothesis suggestions their characteristics are presented. These literature study evidences are subsequently used as primary inputs in the translational model to access the suitability of the existing or proposed design elements or factors in context of stress reliving outdoor space design in an educational institute .

Lighting

Nature and importance -Light serves for various purposes: to make spaces to find the orientation, to reveal or conceal the spatial volume or features, or to draw attention to a task. Our perception and desire for light also varies among the purposes we will need the light for, for example Spaces for meditation or relaxation have different light requirement than that of space for physical activities.
Daylight may serve a vast spectrum of users without any major problems but direct day lighting may cause certain discomfort. The Daylight produces glare and direct incidence can also heat up the environment and may reduce the usability of the space. The space in the outdoor environment like meditation rooms or learning rooms may be designed within an envelope of with low transmitting glasses, or shadings, also general outdoor spaces should be designed such that the direct incidence of western and south western lights can be avoided with shading from natural elements.

Lighting as an Environmental Stressor-Of particular interest is evidence that stress levels are responsive to light conditions. The association between stress, cardiac, and healing (immune and inflammatory) responses is now well documented [Sternberg ,2003] .
Many studies show that stress responses change rhythmically with diurnal modulation, and yet our built environments provide constant, non-cycled light settings. The relationship between light and stress relief outcomes is most important in outdoor environments.

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Neurological Impact-Every species on earth exhibits a wide range of biological cycles that repeat approximately every 24 hours .These are known as circadian rhythms (circa –approximately ,dies-day) and are exhibited at every level of biological systems, from timing of DNA repair in individual cells to behavioural changes ,like the sleep-wake cycle. Considering the significance of the light-dark cycle for regulating biological functions, and the accumulation of evidence from epidemiological and animal studies linking circadian disruption to compromised health and well-being [Edelstein ,2006] .

While there is a significant body of evidence that demonstrates that electrical lightsources can be used to drive many circadian responses, it cannot be said that a singleelectrical light condition can replace solar light as a means to stimulate all circadianeffects. Many human systems respond to circadian and seasonal lighting changes. Onlya few aspects are well understood, and more research is clearly required. Nonetheless, we can form some general design hypotheses based on current findings that are expressedbelow.

Optimal Conditions-A published model of human circadian photo-transduction (i.e., the conversion of optical radiation incident on the retina to neural signals) was used to estimate levels of circadian stimulation from four typical outdoor light sources as might be experienced by people under different realistic scenarios. The approach taken was to determine whether sufficient light is incident on the retina to reach a working threshold for stimulating the circadian system and, thereby to ascertain whether and to what degree outdoor lighting might stimulate the circadian system, as measured by melatonin suppression.

Knez (1995) and Knez and Kers (2000), studying differences between cool white andwarm white light in relation to mood, also discovered differences for males and females.Males' mood is best around 3000K, whereas females' is best around 4000K(context governed) .

During night a 6900 K LED is predicted to have a modest stimulating effect after a one hour exposure (corresponding to 12-15% Nocturnal melatonin suppression).A reasonable and conservative working threshold for suppressing nocturnal melatonin by light at night following a 30-minute exposure would be about 30 lx at the eye for a "white" light source.It is expected that human function, performance, biological, medical, and mood responseswill change subject to lighting conditions. This is not to say that the simple response ofcreating more light or more windows will suffice. Architectural and electrical lightingmust be designed for users, their function, and their environment over time.[The Latrobe laboratory experiment ,2005]

Colours

Nature and Importance-Perceived colour is based on the relative activity of ganglion cells whose receptive field centres
receive input from red, green, and blue cones. It appears that the ganglion cells provide a stream of information to the brain that is involved in the spatial comparison of three opposing processes: light versus dark, red versus green, and blue versus yellow [Bear, Connors& Paradiso ,2006].

The relationship between light and color dictates that neither can exist without the other. In fact, light and color enhance
each other's life and energy. There are seven colors in the visible spectrum of light: red, orange, yellow, green, blue, indigo, and violet; all of these colors are present in visible light. The energy of color is derived from light, and that energy

evokes both psychological and physiological responses in the body . The response of the body and mind to color is influenced by cortical activation, the autonomic nervous system, and hormone activation. Color evokes emotional responses that produce feelings of serenity or agitation that can aggravate or alleviate for the human's responses to color). Color can also affect an individual's emotional state, inducing cheerfulness, agitation, or calmness [Starkweather ,Witek-Janusek & Mathews ,2005].Over the centuries, various cultures have used color for its healing powers .Ancient Egyptians designed chambers to produce a ray of prism light used for healing the sick. In Indian culture, each color is assigned to various energy centers of the body. Color has electromagnetic energy that can influence healing in similar ways to sunlight. The field of chromo therapy uses color as a therapeutic tool in the treatment of various disorders [Fontaine ,Briggs & Pope-Smith ,2001].

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Color by design can be used to supplement the existing light in patient rooms and contribute to the healing milieu.

Neurological Impact-Since perception of colours differ from age to age and between mental states, for enriched environments it will be a more common approach to determine the colours by their brightness colours instead of grouping them with their perceptions. When colours are brighter they will behave as stimuli since they are more recognizable. Brains remember the things easily that are more remarkable. If the colours are used in connection with the spaces, it can strengthen the position in the mental map, and stimulates the memory. However same stimuli are not desired for every function. The brighter the colours, the more attention they attract. It would be a better solution to involve neutral colours, with less contrast, and preferably light colours to perform with lighting.[Serpell ,1969]
Colour preference has been studied for several decades and across many cultures. Thefollowing paragraph reviews a small subset of this work in order to demonstrate the complexity thatmust be accounted for in designing colour experiments, and for the interpretation of theresults.

Optimal Conditions for Stress relieving Environment- Tofel et al. (2003), having reviewed 3000 citations, found "no direct linkages betweencolour and health outcomes," with insufficient evidence in the literature to imply thefollowing causal relationships. They concluded that "colour's influence on emotionalstates or mental and behavioural activities is unsubstantiated by proven results." Theyfound that "colour-mood associations exist, but that there is no evidence to suggest a oneto one relationship between colour and emotion. Certain colours do not contain inherentemotional triggers." Rather, "emotional responses are caused by culturally learnedassociations and by the physiological *and* the psychological makeup of people."
The Society of Critical Care Medicine recommends using calming colors that promote rest in critical care units .Blues, greens, and violet are appropriate, because they have healing and calming influences and are stress-reducing colors. Reds, orange, and yellow colors should be avoided, because they induce excitement, increase blood pressure, and can cause fatigue . Many studies have concluded that cool colors have a tendency to calm, whereas warm colors excite.

Sound

Nature and Importance- Sound stimulation at high sound pressure levels is known to be a potent stressor, evoking unpleasant feelings (annoyance) and physiological stress reactions .Studies on the connection between sound environment and stress recovery are currently lacking.
Neurological Impact-Soundscape research has shown that natural sounds are typically perceived as pleasant and technological noise as unpleasant components of the sound environment It is therefore plausible that the sound environment may have a similar effect on stress recovery as the visual environment.

Optimal Conditions-The present results suggest that recovery from sympathetic arousal is affected by type of sound (nature sound *versus* noise). Recovery was faster during the nature sound (50 dBA) compared with the noises, including the low noise (50 dBA) and the ambient noise (40 dBA). The mechanisms behind the faster recovery could be related to positive emotions (pleasantness), evoked by the nature sound as suggested by previous research using non audio film stimuli Other perceptual attributes may also influence recovery. The Ambient noise was perceived as less familiar than the other sounds ,presumably because it contained no identifiable sources. One may speculate that this lack of information might have caused an increased mental activity and thereby an increased SCL, compared with the nature sound . An effect of sound pressure level can be seen in the difference between high and low noise, this difference is in line with previous psychoacoustic research and is not a surprising considering the large difference (30 dBA) in sound pressure level[Serpell ,1969].
The results from SCL are consistent with those of Ulrich *et al.* , who found a faster decrease in SCL after audio-visual exposure to natural compared with urban environments.
The effect of natural sound environments on stress recovery may be greater in situations with longer exposure times and with lower sound pressure levels commonly found in recreational and rural areas outside cities. In city parks and other urban outdoor areas, the sound environment is typically a mix of sound from nature sounds and traffic noise. Based on the present results, it seems plausible to speculate that recovery from sympathetic activation in such areas would be less effective than in areas undisturbed by noise.

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The present results suggest that after psychological stress, physiological recovery of sympathetic activation is faster during exposure to pleasant nature sounds than to less pleasant noise of lower, similar, or higher sound pressure level.

Smell

Nature and Importance- The sense of smell plays a significant role in how humans perceive and react to environments in which they are placed. The basic foul smells from an environment evoke strong reactions .Studies show that exposure to such smells can produce anxiety and increase heart rate and respiration .Controlling the many and varied stress-producing smells in an outdoor environment is a daunting task and there must be measures taken to curb its effect.

Neurological Impact-The human sense of smell is inexorably linked with the environments in which people live. The information received through the senses evokes physiological responses and feelings .Scents stimulate the olfactory system and can trigger an immediate response [Buckle ,Marsh & Sydney ,2001].The sense of smell is more intertwined in the memory and emotions than any of the other senses [Chu & Downes ,2000]. Indeed, the sheer thought of a smell can trigger a memory or reaction [Buckle ,Marsh & Sydney ,2001]. The sense of smell stimulates reactions and actions at both subconscious and conscious levels.

Optimal conditions-Some suggestions include removing offensive odors from the immediate environment as quickly as possible and providing other, more pleasant odors to supersede the noxious ones, such as vanilla, lavender, and mint.

smroF

Nature and Importance-Human beings connect physiologically and psychologically to structures embodyingorganized complexity more strongly than to environments that are either too plain, orwhich present disorganized complexity [Salingaros & Masden ,2007] .It follows that the builtenvironment performs a crucial function — in some instances to the same degree — asdoes the natural environment.

Neurological Impact-Neurological nourishment depends upon an engagement with information and itsorganization. This connective mechanism acts on all geometrical levels, from themicroscopic, through increasing physical scales up to the size of the city. The correctconnective rules were rediscovered repeatedly by traditional societies, and are appliedthroughout historic and vernacular architectures. Traditional ornamentation, colour, articulated surfaces, and the shape of interior space helped to achieve informationalconnectivity. Long misinterpreted as a copy of natural forms, ornamentation in its deepestexpressions is far more than that: it is a distillation of geometrical connective rules thattrigger our neurophysiology directly. These qualities are emphatically not present in thedominant architectural ideology of the twentieth century.

Optimal conditions-The Biophilic Architecture theory suggests that neurological nourishment comes strictly fromliving biological forms. they suggest ornamented forms and surfaces are derivative ofnatural forms, and thus provide only a second-hand (i.e. vicarious) experience. On the other hand most of the contemporary architects believe that the underlying geometrical complexity of living structure iswhat nourishes humans. This geometry could be equally expressed in biologicalorganisms as in artefacts and buildings: the difference is merely one of degree[Alexander ,2002-2005]. If implemented correctly, it is not neurologically discernable,only more or less intense. Every living being incorporates this essential geometry to anastonishing degree (in its physical form), whereas only the greatest of human creationseven come close. In this view, the distinction between the living and the artificial is leftintentionally vague, and life itself is drawn closer to geometry. At the same time, thisapproach helps to explain the intense connection people feel with certain inanimateobjects, i.e. the artefacts and creations of our human past. Traditional techniques for creating neurologically-nourishing structures are wedded tospiritual explanations, which are often unacceptable to contemporary architects (and to clients). Not surprisingly, the most intense connection is achieved in historicsacred sites, buildings, and artefacts. It is only in recent times that a scientific explanationhas been given for what were originally religious/mystical practices of architecture and design [Salingaros & Masden ,2007]][Alexander ,2002-2005] .

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Landscape Features

Natural Environment and its Importance-Human beings are biologically predisposed to require contact with natural forms.Following the arguments of Edward Wilson (1984), people are not capable of living acomplete and healthy life detached from nature. By this, Wilson means that we benefitfrom direct contact with living biological forms, and not the poor substitute we see in somany urban and architectural settings today. Wilson's *Biophilia Hypothesis* (1993) asserts thatwe need contact with nature, and with the complex geometry of natural forms, just asmuch as we require nutrients and air for our metabolism.
Environments devoid of neurologically-nourishing information mimic signs of human pathology. For example, colourless, drab, minimalist surfaces and spaces reproduce clinical symptoms of macular degeneration, stroke, cerebral achromatopsia, and visual agnosia .We feel anxious in such environments, because they provoke in us a similar sensation as sensory deprivation and neurophysiologic breakdown.
The need is to point out the importance of relying on clinical studies rather than on surveys. Many studies recording user preferences have been done over decades, some of them uncovering the advantages of natural environments, and of environments mimicking those geometrical qualities [Joye ,2006-2007].
A flat lawn, by contrast, while better than a rectangular concrete slab, represents the same visual purity (emptiness) as the plain slab. Our senses perceive it as a single scale and are unable to connect to it factually. Moreover, lawn is anti-ecological asmonoculture is irrelevant to localecology, because it exists on a single ecological scale and is unstable in nature .

Neurological Impact-When it comes to stimuli, nature with varieties in color and geometries is a rich stimuli, that we are naturally encoded to be stimulated. In other words nature provides a source of neurological nourishment. Nature exhibits ecological complexity: interacting plants that in turn provide visual complexity, which is a source of neurological nourishment. [Masden ,2006] .While artificial stimuli is not perceived in the same way by everyone, natural stimuli serves both for distraction and relaxation.

In hospital settings effect of nature on reducing patient stay have been studied comparing the process of patients in different rooms according to their view to nature . Including that from prospective randomized controlled studies, it has shown that exposing patients to nature can produce substantial and clinically important alleviation of pain [Ulrich ,Zimring ,Zhu ,Dubose, Seo ,Choi ,Quan, & Joseph ,2008]. Therefore maximizing the opening to the nature will maximize the effect of treatments and speed up the healing process.

Optimal Conditions-Evidence collected by marketing firms in America suggests people's preferences for the wilderness or decisions to move to rural environments are related to the desire both to escape the stressors of a fast-paced urban environment, as well as to become engrossed in a more "soothing" and "healthy" setting[Stilgoe ,2001].

Patterns

Nature and Importance-Exploration of patterns recognized by our neurophysiologic apparatus are a key to understandinghumanity and its connection to the universe. Patterns organize individual actions intomore complex wholes. While this is a process well understood in a language, wherewords are combined to achieve a meaningful message, it remains outside most people'sanalytical understanding of the world.

Neurological Impact-Cognitive psychologists recognize patterns asschemata that identify certain preferred sensory inputs. Patterns also control coordinatedbody movements. Almost every human activity will be found to contain patterns, andthose patterns generate the forms and connective complexity of traditional architectureand urbanism [Alexander ,Ishikawa ,Silverstein , Jacobson ,Fiksdahl-King & Angel ,1977] .

Optimal conditions- Whereas some design components are contextual (i.e. cultural, temporal, or location-specific), many are indeed universal. Christopher Alexander's *PatternLanguage* codified evolved patterns of how humans interact with their environment andwith each other .This prescient book established a practicalcombinatory framework

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for design, based on evolved solutions. Incidentally, it alreadycontains many of the key concepts that later came together to define biophilic design.
In Appendix A of this paper, we have summarized several Alexandrine patterns. Thereader can readily see how these design patterns anticipate and support restorative or contemplative design.Architects can draw upon the *Pattern Language* ,combining thathelpful knowledge with the latest notions of human adaptivity into an innovative design

V. FIELD SURVEY

Location of survey

The survey was conducted in School of Planning and Architecture ,Bhopal ,India .The college is in a self contained campus located in the exterior region of Bhopal district .Its distance from city centre is approximately 30 kilometres .Also there is no nearby markets or places of public interest and recreation where students can visit and break the monotone of daily life .The campus is enclosed in a boundary wall so there is only visual access to the adjoining open fields but no physical access .This causes high level of frustration and stress among the students .

Participants

The research investigated students from Bachelor's in Architecture course in the School of Planning and Architecture, Bhopal ,India. The participants were asked to fill out a number of surveys that measured their perceived stress level, stress relieving measures and description of stress reliving environments and factors . No identifying information was requested and there was no additional screening of participants.
Out of the hundred (100) participants ,Fifty-five identified themselves as female and 45 identified themselves as male. The mean age of the participants was 20.52 years. The majority of the students were between the ages of 19 and 22 years. The range was 18-25 years. Forty-one of the participants were 20 years old, 30 were 19 years old, and 11 were 21 years old.
Eighty-five of participants identified themselves as single, 10 identified themselves as being in a long-term relationship, 2 identified themselves as engaged, and 3 identified themselves as being partnered.

Survey1

Measures

The Perceived Stress Scale (PSS) created by Cohen (1983) is a 10-item scale developed to provide an objective measurement of individuals' perceptions of stressful events. Reasons why such a measurement is useful include the simplicity of the questioning procedure, the lack of subjective bias, and the potential for an estimate of which events could be identified with increased risk of disease. It is an appropriate instrument for the current study because it is a valid self-report that conveys how much stress a student believes himself or herself to be under.
The items are easy to understand and the response alternatives are simple to grasp. The questions are general in nature and relatively free of content specific to any sub-population group. The PSS-10 can be used to determine whether "appraised" stress is an etiological factor in behavioural disorders or disease. Items of the PSS were designed to tap how unpredictable, uncontrollable, and overloaded respondents find their lives . PSS-10 has been found to provide better predictions for psychological symptoms, physical symptoms and utilization of health services than other similar instruments [38]. In a cross-sectional study, higher PSS scores were associated with greater vulnerability to stressful life-event-elicited symptoms [39].
Scoring and Interpretation:
The two factors in the PSS were named Perceived Helplessness (comprised of items 1, 2, 3, 6, 9, and 10) and Perceived Self-efficacy (comprised of items 4, 5, 7, and 8, which are reversely coded when computing the total score).

Procedure

The participants were given a survey questionnaire and asked to provide honest responses to the questions. All of the questions were closed, which means that students were asked to provide the best option from among choices (for example Strongly Agree to Strongly Disagree). Participants were only tested once during the research study, and there was not a follow-up session
The Perceived Stress Scale (Cohen et al., 1983) was used to obtain a measure of stress experienced by students[37]. Low stress scores range from 0 to 15 ,15 to 20 were high and above 20 very high. PSS scores could range from 0 to 40.

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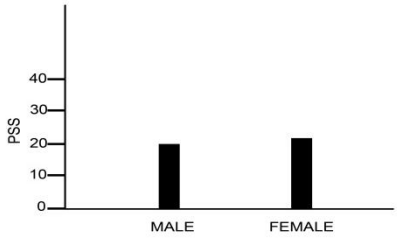
Results

The average stress score for the students was 21.57 .The average PSS score for girls was 22.30 and for males it was 20.68 .

Figure 1 (a) Average stress level of the participants on gender basis

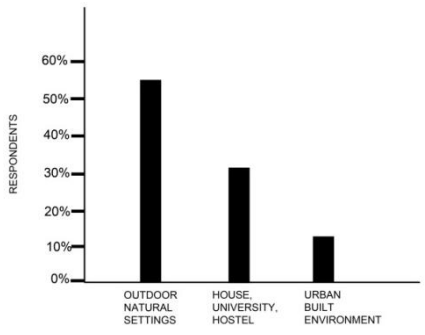


(a)

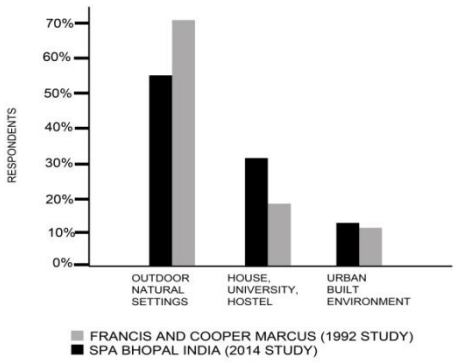
Survey2

The survey was essentially conducted as two questionnaires the first one was primarily a replica of the survey conducted by Cooper Marcus and Barnes in 1991 in which they were asked to recall an occasion when they had been feeling particularly stressed, upset, depressed, angry, confused, or grief-stricken, and they had gone to a particular place that helped them feel better. The survey used is shown in Appendix B. They were asked to describe the place, what happened to them , and which specific elements or place qualities seemed to lift their mood. In survey results, respondents showed a marked preference for outdoor settings — 68% of the sample of 100 students.85 % of the students described natural settings and 40% of them described designed outdoor settings such as a park or college and rest of them preferred natural land forms .Findings from this survey align quite well with Ulrich's theory of restorative garden design, the principles of biophilia, and available research about the health benefits of contact with nature.

FIGURE 2- (a) Preference of the participants of where they go when stressed,(b) SPA , Bhopal study,2014 vs. Francis and Marcus Cooper 1992 study of preference of people go when they are stressed



(a)



(b)

Survey3

The third questionnaire was based on accessing the qualitative and the quantitative attributes of the environmental factors that people believe to have helped in alleviating stress. The survey used is shown in Appendix C [41] .The components studied included light ,colours ,sound ,smells ,patterns and forms .The results of the questionnaire were as follows;

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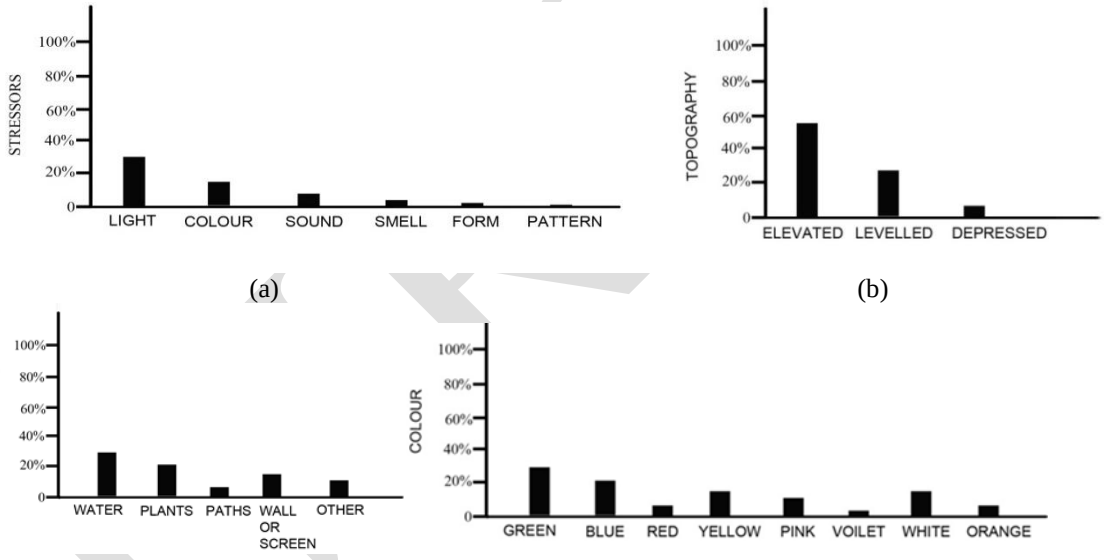
- The order of preference for factors of healing space were 1.light ,2.color ,3.forms 4.sound ,5.smell and 6.patterns
- Most people tend to like flat , levelled and open spaces.
- Most important stress relieving element was found to be plants followed by water features .
- Colour preference was highly variable but a consistent liking towards green and blue colour was observed
- Most people felt relieved in open daylights but preferred shaded and cool areas. Glare and heating are the main problem associated with direct day lighting.
- Most students liked organic and natural forms over plain and monolithic forms.
- Students preferred geometric patterns with curves but with varying textures and colour patterns.
- Most students preferred that the place should be calm and silent and urban noises were a disliked .Most of them like to hear from their gadgets while some preferred to hear to the natural sounds of birds or water features.

The results from these survey can be used along with the neuro-scientific evidence found this context and then processed in the proposed model to find out the qualitative and quantitative attributes of these environmental factors that would be apt for an outdoor spaces with healing properties.

FIGURE 4-(a) Most important environmental or physical factor in stress relieving environment. (b) Topography of the stress relieving environment. (c) Most important stress relieving design feature or element. (d) Preference of colour in the stress relieving environment



(a) (b)

(c) (d)

VI. FINDING'S FROM FIELD SURVEY AND THE NEED OF STRESS RELIEVING SPACE IN AN EDUCATIONAL INSTITUTE

The purpose of this part is to discuss the findings of the research on stress relieving outdoor environments and the findings of the research on neuro-architecture, theories on restorative space design and biophilia and to determine if a restorative space would beappropriate for an educational institute . In addition, it will be determined if anoutdoor environment would extend and enrich the learning process ,neurological nourishment and stress relief. And finally, to meet the primary objective of this research, the data collected can be processed in the proposed translational model to

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access the qualitative and quantitative attributes of the design elements and factors for a stress relieving outdoor environment.

WHY OUTDOOR ENVIRONMENTS?

As Marcus and Barnes stated in *Healing Gardens (1999),* the term healing is quite broad andgenerally refers to a beneficial process that promotes overall well-being. Within thehealthcare setting, however, there are three specific aspects of the healing process thatcan be identified: stress reduction, relief from physical symptoms or awareness of thosesymptoms, and improvement in the overall sense of well-being. Stress oftenaccompanies sickness and hospitalization.

Stephen and Rachel Kaplan (1989) believe that the contemporary built environment taxes oursenses and demands us to remain in a state of forced attention. They suggest that arestorative experience, preferably nature, is needed to recover from this overload ofsensory input. Once thesensory demands on the individual are lessened, the level of stress is reduced as well. Ifredesigning the indoor environment reduces stress, then it follows too that redesigningthe outdoor environment should have this same effect. Most humans choose the natural environment because of its ability to calm and restoreus during times of stress. Studies with hospital patients, who are under considerablestress, indicated that the patients used the hospital gardens to relieve some of the stress that accompanies sickness and hospitalization. Therefore, if altering the indoor environment calms the individual and reduces stress, then a well-designed outdoor environment will do at least that. However, with emphasis on the natural elements of green grass, plants, trees, and the soothing sound of water there are even more tools available to the designer of the outdoor environment to help reduce stress.

It is therefore crucial that outdoor or open space design strategies, which aim to reduce these stress, should consider appropriate design components, features and characteristics alongside already accepted clinical, behavioural and technological interventions.

BENEFITS OF OUTDOOR SETTINGS IN AN EDUCATIONAL INSTITUTE

In the modern times educational institutes have become engines of progress for the mankind. Faculties ,researchers and students are constantly engaged in producing quality works, coupled with highly competitive work environments, under consistent pressure of time .This takes a heavy toll on the health of this population .Our primary survey conducted in an Architecture college showed that more than 60 percent of the student population scores very high on perceived stress scale. Thus It can be evidently concluded that population in an educational institute are in a dire need of stress relieving outdoor space, that would alleviate stress and help restore well-being among users.
An outdoor landscape for stress relief would be beneficial to the users in a number of ways;
1. It would be a space where users can go after a stressful event.
2. A place for meditating and calmness.
3. Engage in physical activities.
4. Help reset biological clock of the body by taking in proper considerations for circadian lighting.
5. Aid in restoring well-being and a source of neurological nourishment.
6. Alleviate anger, anxiety, loss of concentration and mental fatigue.
7. Place for social interaction.

VII. THEORY OF TRANSLATIONAL MODEL

TRANSLATIONAL SCIENCE

Neuroscience offers not only a wealth of knowledge, but also a rigorous methodology to validate findings and provide a framework for translating basic science from ‘bench to bedside’.
Followed carefully, this model facilitates the creation of credible evidence-based solutions that serves medicine well. As such, it also provides the foundation for innovation and intellectual leaps toward novel solutions.

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"Achieving those objectives requires assembling building blocks of bits and bytes of information accumulated through the work of neuroscientists from across all disciplines within the field, and using knowledge and approaches from related fields. "[Barnes ,2005]

TRANSLATIONAL DESIGN

An analogous 'translational design' approach has been proposed in which the interpretation of scientific findings into terms relevant to architecture can offer validation for design hypotheses.
Rigorous study design and analysis provides a paradigm for developing repeatable results leading to greater predictability about responses to environmental features. These building blocks, in combination with findings from the related disciplines of Sociology, Psychology and Anthropology provide a broad basis informing design applications[Zeisel ,2005][Ulrich ,Quan , Zimring ,Joseph &Choudhary ,2004][Ballisto &Allison ,2001][Shepley ,1996].

TRANSLATIONAL MODEL APPROACH

The research proposal framed a research model with two mandates:
• Utilize scientific methods from the behavioural sciences and neuroscience, as well as the inductive reasoning that augments suitable environment setting and elements that can be used in the design process
• Seek psychological, behavioural and physiological responses to design elements .

The research proposal also comprised of two concurrent focal points:
• In a disciplined manner, observe, assess, refine and document the approaches used to create the research, in order to allow the profession to learn from those processes for potential future applications. (The Model)
• Conduct more contextual surveys and align them to the growing neurological findings to refine and expand the structure of model. (The Framework)

COMPONENTS AND STRUCTURE OF THE TRANSLATIONAL SCIENCE MODEL

This chapter describes the primary research strategy the authors used to create a tool, the Translational Science Model(TSM), that can be used to answer important, current questions about the impact of design elements on stress relief of users of an outdoor environment . This tool integrates classes of data (taken from primary and secondary sources) never before connected,existing theories on stress reliving outdoor environment design, neurological implications of physical and environmental factors ,behavioural ,clinical and contextual evidences found in the context .Broadly speaking, this coordination allows architects and designers to understand the effect of architecture on stress relief in context of educational institutes . The tool is especially powerful because of the pooling of wide range of knowledge from various disciplines, which allows to identify and understand the effect of various factors .
This chapter describes this model, its component parts, and when, where, why, and how it can be applied .

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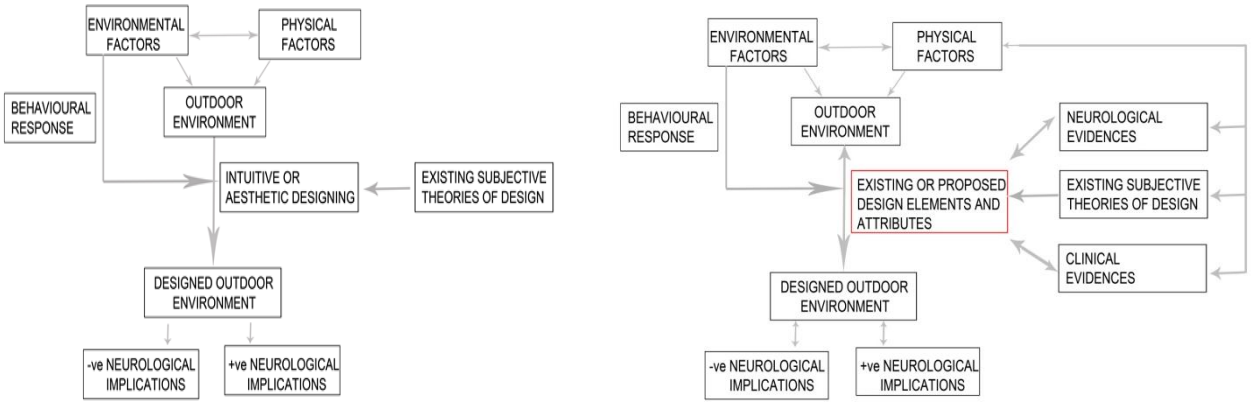

FIGURE 8-(a) Layout of the conventional strategy of design of outdoor environments, (b)The Translational model

WHEN, WHERE AND HOW TSM CAN BE USED?

Specifically and immediately, it can be used as a tool to guide the design of outdoor spaces for stress relief in an educational institute and to provide operational guidance for using and modifying existing structures.

A step-by-step guide to using the TSM model

1. Create a research question relative to a specific outdoor environment design and/or design attribute.
This research question can be developed into a hypothesis based on a literature review, evidence created through focus groups, or operational necessity, etc. For example, a research question might be, "Do natural sounds produce stress relief" .The general hypothesis is that natural sound affects stress relief; a specific hypothesis might suggest that natural sounds have neurologically ,behaviourally and clinically proven to mitigate stress[10].

2. With this general hypothesis in mind, and the contextual evidences gathered a positive neurological implication or positive loop provides the designers or architects to access the suitability of the design attribute in context of stress relieving environment.

3. Test the possible relationships among the various factors on the possible neurological outcome.

4. Check for intervening variables, such as natural or man-made disturbances,pollution etc.

5. The second phase in the research would be to design some well-considered interventions in order to test research findings in practice. Published research that have established compelling hypotheses could lead to clinical and architectural experiments. In either case, a hypothesis from any source would have to be well substantiated before committing resources to test it.

6. Perform direct measurements at these sites as required to capture any new features that will need to be evaluated post-occupancy or post-intervention.

7. Use the pre-intervention data as a baseline to measure the effects of the intervention.

8. Collect the post-intervention data.

9. Compare pre- and post-intervention data to determine the impact and outcome of the intervention.

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10. Generalizing and establishing guidelines for design elements and attributes that have positive stress relieving effects.

BENEFITS OF USING THE TSM

This study has the capacity to make many contributions to the project of defining and designing stress relieving outdoor environments. If the model is used in a systematic way to create contextual or clinical evidences in a setting, in time it will be possible to articulate what creates a stress relieving environment. Once all of the components are known, architects and designers can successfully create stress relieving environments in many outdoor settings.

Architectural practice will potentially benefit, starting with those architects who specialize in outdoor environment design. For various reasons, architectural practice is often not based on systematic evidence. The TSM model will offer an effective way to include research data in practice because it can create a large body of scientific evidence that is directly relevant to stress relieving outdoor environment design decision-making.

Ultimately, the model will be used because it will improve outdoor environment design, which, in turn, will benefit so many different user groups .

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FUTURE RESEARCH PROPOSALS

The TSM already includes other variables that would allow relatively quick analyses to be conducted on other design related topics. These are beyond the content focus of the presented study, but we mention them here to give a further sense of the potential of the tool. For example, since we have information on the crowding density in an outdoor space , we could measure the impact of crowding by accessing the change in stressors levels that are beyond optimal range and also through perceived stress scale(PSS) survey and neurological experiments.

But ,the structure of the research will require careful consideration, especially if additional measures need to be created. But the length of a research project will be reduced substantially from the view point of time.

FUTURE RESEARCH APPROACH AND CONSTRAINTS

The purpose of research in general is to pose questions with uncertain outcomes. As such, sometimes the outcomes match the expectation or predisposed intensions, and sometimes they do not. The research findings of various environmental and physical factors as presented in Chapter 3 of this paper specific findings and implications of those findings are illustrated. Each stands on its own, illustrating the nature of the research question, positioning the work in a larger body of work, setting forth a methodology of exploration, and reporting the outcomes. Each of these research tracks was highly influenced by the organizational conditions of the context in which the research was conducted, and the larger expectation that it to be a thread of connection in the work.

The model sets its foot in multiple disciplines thereis overlapping, disciplinary engagements that would lead to trans-disciplinary outcomes.

In addition it was expected that the model would yield results in context of the quantitative attributes of the factors studied .In case of some factors this kind of result can be yielded but not in all factors .It can be accessed that this does not represent failure, but reflect the nature of the struggle to undertake meaningful and important research.

In an effort to illustrate the underpinning issues and factorsthat demonstrated the nature of that struggle, the following is a set of guidelines for new researches .In looking to the future; it is these conditions that will allow the framing of new research efforts in practice to gain from the TSM tool.

These observations are grounded in the materials previously documented above that reflect outcomes from clinical and natural experiments, research reports, and the process questionnaire.

We have listed some items from primary understanding and the Latrobe laboratory experiments (2005) that represents a significant aspect of the future research experience.

*ON**avigating disciplinary boundaries.** All of the prospective investigators share the basic scientific model of research (whether social, organizational, or biological), they make communication fairly straightforward and about rigor and quality. What makes this work interdisciplinary is that the independent variable is design and the outcome variables are physical, social, and organizational.*

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O***New ways of knowing.*** *This kind of research would create "new" knowledge and may create knowledge in a "new" way.*

O***Agreements are central to progress.*** *This is an iterative process. Whatever agreements made along the way certainly will positioned challenges and introduced changes at every step of the process.*

O***Implicit vs. explicit knowledge.*** *As practitioners, both our education and practice center on "problem resolution"; as such knowledge tends to be "problem specific" and thus not seen as directly applicable to the next problem because of its dependency on context of application. This suggests that it is only after many years of practice that a body of knowledge is developed experientially. Additionally, the process of developing knowledge is redundant for the individual and difficult to transfer to others within or outside the profession. It is this culture and practice that research for the purpose of creating multiple forms of evidence and, more specifically, evidence-based design are challenging.*

O***Language is central to understanding.*** *The search was for trans- or interdisciplinary (scientific) processes that provided insight into how one acquires knowledge that can be additive to a practitioner's typical problem resolution process (context of specific application) and that enhances predictive performance outcomes. Thus far, lack of a common language, processes, and protocols makes this process slow and difficult. This model aims to be the starting point for the generation of a new body of expertise that would speak both the language of science and the language of design.*

O***Knowledge always in context.*** *Knowledge produced in context is not new, but it is how context is defined that creates the challenge. The assumption here is that if the knowledge is to be accepted, the parties with vested interest—architects, clients and researchers—must socially construct it.*

O***Outcomes to serve the majority.*** *"Clinical research" is in many ways the healthcare equivalent of "research in context." It must address the many complex factors that define each individual preferences and his other unique needs and values, while investigating specific questions directed at creating applications that serve to improve outcomes for the majority of people and circumstances.[48]*

VIII. CONCLUSIONS AND DISCUSSIONS

It is clear that the future of the architecture profession is grounded in knowledge management: what do we know; how do we know it; and how do we renew that knowledge in the fast changing world of practice.
The translational science model would help to document this knowledge, in a disciplined manner, to observe, assess, refine and document the approaches used to create the research in order to allow the architectural profession to learn from it and apply the outcome in future architectural practice settings.
The next steps must be grounded in the identifying metrics for suggesting a set of physical attributes of architectural spaces that serves human healing process so that stress relief can be measured. The research model made suggests that it is possible to establish a robust field of empirical evidence that can inform the outcomes of architectural practice, specifically focused on stress relieving environments. It also suggests that the processes and methods used here are transportable to other environmental facility types and settings.
In terms of the model, it can be said that the concept of collaborative research is a critical form of inquiry that needs to be pursued in the discipline and profession of architecture.

It is safe to recommend that the framework of the four defining elements of translational model are important to collaborative research, i.e., research generated in a context of application, trans-disciplinary and socially constructed measures of quality, conducted across knowledge organizations and sites, reflexive, and concurrent with the need in architectural practice to merge the outcomes of research with actionable design results and with a degree of trust in the empirical evidence by the larger community of practitioners and researchers.

It is well understood that our future in architectural practice will be highly influenced by such translational designs. It is important to recognize that evidence comes in many forms, from personal experience (intuition), to best practices, to

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rigorous scientifically established findings. As such, evidence for use in architectural practice does not need to be all in one form or another, but as in medicine, practice must use the evidence from as many sources as possible to predict the nature of the outcome of specific actions. The critical issue here is not the evidence itself, but the transparency of the evidence, so that others can judge and understand the impacts and influences of specific forms of evidence on performance.

The translational science model can contribute to this dialogue concerning knowledge production (evidence) and its application and translation.

The translational science theory provides fertile arenas for future research and the model for conducting research in practice. Yes, there is still work to be done, but these studies can make significant contributions, and a direction can been established that, if pursued, will continue to produce significant outcomes.

REFERENCES

1. Alexander, C. (2002-2005) *The Nature of Order, Books 1 to 4* (Berkeley, California: Center for Environmental Structure).
2. Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I. &Angel,S. (1977) *A Pattern Language* (New York: Oxford University Press).
3. Annerstedt, M., &Wahrborg, P. (2011). Nature-assisted therapy: Systematic review of controlled and observational studies. *Scandinavian Journal of Public Health, 39*, 371-388.
4. Ballisto, D. and Allison, D. (2001) The Nature and Rate of Change in Hospital Laboratories. Coalition for Health Environments Research.
5. Barnes, C. (2005) Moving Toward a Redefinition of Translational Research. Neuroscience Quarterly. Spring, p.1-2
6. Bear, Connors, Paradiso--"Neuroscience: Exploring the Brain" 3rd Edition ,2006
7. Chu, S., &Downes, J. J. (2000). Long live Proust: The odour-cued autobiographical memory bump. *Cognition, 75*(2), B41-B50.
8. Cohen, S., Kamarck, T., &Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behaviour, 24*, 385-396.
9. Cohen, S., & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan, & S. Oskamp (Eds.), The social psychology of health: Claremont symposium on applied social psychology. Newbury Park,CA: Sage
10. *Eberhard, .J. Brain Landscape,*
11. Edelstein, E. A. (2006) Excerpts from: Translational Design: The Intersection of Neuroscience & Architecture. Master of Architecture Thesis. New School of Architecture & Design, San Diego.
12. Edelstein, .Eve. A., Ph.D.The latrobe laboratory experiment ,
13.Fontaine, K., Briggs, L., & Pope-Smith, B. (2001). Designing humanistic critical environments. *Critical Care Nursing Quarterly*, *24*(3), 21–34.
14. Francis, C., & Cooper Marcus, C. (1992). *Restorative places: Environment and emotional well-being.* Paper presented at the 24th Environmental Design Research Association Conference, Boulder, CO.
15. Gerlach-Spriggs, Nancy; Kaufman, Richard Enoch and Sam Bass Warner, Jr.1998. Restorative Gardens. Yale University Press. New Haven and London.
16. Guite, H. F., Clark, C. and Ackrill, G., 2006, 'The impact of the physical and urban environment on mental wellbeing', Public Health, vol. 120, no. 12, pp. 1117–1126.
17.Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., &Garling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology, 23*, 109-123.
18.Healing Gardens: Creating Places for Restoration, Meditation, and Sanctuary , A thesis Prepared by Annalisa Gartman Vapaa ,pg 78-79
19. Joye, J. (2006) "An Interdisciplinary Argument for Natural Morphologies in Architectural Design", *Environment and Planning B*, **33**: 239-252.
20. Joye, J. (2007a) "Towards Biophilic Architecture: Drawing Lessons from Psychology", *Review of General Psychology*, **11**: in press.
21. Joye, J. (2007b) "Fractal Architecture Could be Good for You", *Nexus Network Journal*, **9, No. 2**: in press.
22. Kaplan, Rachel and Stephen Kaplan. 1989. The Experience of Nature. Cambridge University Press.
23.Kellert, S. (2008). Dimensions, elements, and attributes of biophilic design. In S. Kellert, J. H. Heerwagen& M.Mador (Eds.), *Biophilic design: The theory, science, and practice of bringing buildings to life.* Hoboken, NJ:John Wiley & Sons, Inc.
24. Kellert, S. R. (2005) *Building for Life: Designing and Understanding the Human-Nature Connection* (Washington, DC: Island Press).
25.Kellert, S. R. & Wilson, E. O., Editors (1993) *The Biophilia Hypothesis* (Washington,DC: Island Press).
26. Kuiper NA, Olinger LJ, Lyons LMGlobal perceived stress level as a moderator of the relationship between negative life events and depression.
27. Martin , . Mike. W., Ph.D. Developing an Evidence-Based Design Model that Measures Human Response: A Pilot Study of a Collaborative, Trans-Disciplinary Model in a Healthcare Setting , pg192-193
28.Masden, K. G. II (2006) "The Education of an Urbanist: a Real Point of View", in José Baganha, Editor, *The Teaching of Architecture and Urbanism in the Age of Globalization*(Casal de Cambra, Portugal: Caleidoscopio Ediçao e ArtesGraficas): 173-179.
29. Marcus, Clare Cooper and Marni Barnes. 1995. Gardens in Healthcare Facilities: Uses, Therapeutic Benefits, and Design Recommendations. The Center for Health Design, Inc. CA.
30. Philip Buckle, Graham Marsh & Sydney Assessing Resilience & Vulnerability: Principles, Strategies & Actions Guidelines May 2001
31.Ragsdale, J. M., Beehr, T. A., Grebner, S., & Han, K. (2011). An integrated model of weekday stress and weekend recovery of students. *International Journal of Stress Management, 18*, 153-180.
32. Salingaros, N. A. &Masden, K. G. II (2007) "Restructuring 21st-Century Architecture Through Human Intelligence", *ArchNet International Journal of Architectural Research*,**1, Issue 1**: 36-52. http://archnet.org/library/documents/onedocument.tcl?document_id=10066.

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology
(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

33. Serpell, Robert. The influence of language, education and culture on attentional preference between colour and form. International Journal of Psychology. Vol. 4(3),1969, pp. 183-194.
34. Shepley, MM. (1996) A User's Guide to Design Research. Journal of Healthcare Design, p. 8
35.Starkweather, A.,Witek-Janusek, L., &Mathews,H. L. (2005).Applying the psychoneuroimmunology framework to nursing research. *Journal of Neuroscience Nursing*, *37*(1), 56–62.
36. *Stein, .J.F. with Stoodley, .C.J., Wiley. Introduction to Neuroscience,*
37. Sternberg, .EM. Neuroendocrine and neural factors in autoimmune, inflammatory, infectious, and allergic disease: a summary of the conference. Ann N Y Acad Sci. 2003May;992:xi-xii.
38. *Sternberg, .Esther. M, Wilson, .Mathew A. Seeking common ground , Cell 127*
39.Stilgoe, J. R., 2001, 'Gone barefoot lately?', American Journal of Preventive Medicine, vol. 20, no. 3, pp. 243–244.
40. Tofel RB, Schwarz B, Yoon S-Y, Max-Royale A (2003) Color in HealthCare Environments: A Critical Review of the Research Literature. CHER.www.cheresearch.org. [Accessed May 1, 2006].
41. Ulrich, R. (1999). Effects of gardens on health outcomes: Theory and research. In C. C. Marcus & M. Barnes(Eds.), *Healing gardens* (pp. 27-86). New York: Wiley.
42. Ulrich, .R. A Review of the Research Literature on Evidence-Based Healthcare Design,
43. Ulrich, R., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M.A., &Zelson, M. (1991b). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, *11*, 201-230.
44. Ulrich, R, Quan, X, Zimring, C, Joseph, A, Choudhary, R. (2004) The Role of the Physical Environment in the Hospital of the 21st Century: A Once-in-a-Lifetime Opportunity The Center for Health Design.
45. Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., &Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, *11*(2): 201-230.
46. Ulrich, R. S., Simons, R. F., & Miles, M. A. (2003). Effects of environmental simulations and television on blood donor stress. *Journal of Architectural & Planning Research, 20*(1),38-47.
47.Wilson, E. O. (1984). *Biophilia: The human bond with other species*. Cambridge: Harvard University Press.
48.Zeisel, J. (2005) in *Inquiry by Design: Environment/Behavior/ Neuroscience in Architecture, Interiors, Landscape, and Planning* New York. W.W. Norton (in Press)

ANNEXTURES

APPENDIX A: Some patterns from *A Pattern Language.[ref. Alexander ,Ishikawa ,Silverstein , Jacobson ,Fiksdahl-King & Angel ,1977]*

We have selected twelve patterns from Alexander's *Pattern Language* (Alexander *et. al*., 1977) to summarize here. A common thread running through Alexander's work is the need to connect human beings with nature, looking to nature as a source of mental and physical nourishment. That work anticipates and supports biophilic design. Like the concept of biophilia, patterns have meaning for human life, and are not simply someone's individual preference. These patterns may provide the architects and designers to inculcate some basic design considerations that should be used in the designing of outdoor environments for stress relief . This Chapter gave scientific validation for these and other patterns, which should prompt their re-consideration by the architectural community. That prescient design framework contains 253 patterns in all, which can be used for generating environments adapted to human sensibilities. The following brief pattern descriptions are our own: the reader is urged to read the original several-page description of each pattern.
PATTERN 24: SACRED SITES. Identify and protect sites having extraordinary importance to the community, whether they are located in a built or green area.
PATTERN 51: GREEN STREETS. Don't automatically build low-density/low-speed roads out of asphalt, but instead use paving stones and gravel set into grass.
PATTERN 60: ACCESSIBLE GREEN. Students ,staff and teachers will only use green spaces when those are very close to where they live and work, accessible by a pedestrian path.
PATTERN 64: POOLS AND STREAMS. People need contact with natural streams, ponds, and reservoirs, so these must not all be covered up.
PATTERN 104: SITE REPAIR. When viewing a building, put it on the least attractive part of the lot, preserving the best of the natural environment.
PATTERN 111: HALF-HIDDEN GARDEN. For an outdoor environment to be used, it must not be too exposed by being out front, nor completely hidden by being in the back.
PATTERN 171: TREE PLACES. Trees shape social places, so shape buildings around existing trees, and plant new trees to generate a usable, inviting urban space.
PATTERN 172: GARDEN GROWING WILD. To be useful, a garden must be closer to growing wild, according to nature's rules, than conforming to an artificial image.
PATTERN 176: GARDEN SEAT. One cannot enjoy a garden if it does not have a semi-secluded place to sit and contemplate the plant growth.
PATTERN 245: RAISED FLOWERS. Flowers provide maximum benefit when they grow along frequently used paths; they must be protected and near eye level.
PATTERN 246: CLIMBING PLANTS. A building connects to its surroundings when plant life grows into it, with the plants climbing up walls and trellises.
PATTERN 247: PAVING WITH CRACKS BETWEEN THE STONES. Paving stones laid directly onto earth, with gaps between them, allow growing plants to create a half natural environment.
There is lack of research in understanding the results on the combinatorial nature of patterns. It is necessary to understand those properties — their linguistic component — before patterns can be most effectively used in design applications. Patterns combine to form more complex coherent wholes; precisely the way matter organizes to form higher-level complex entities. We can apply patterns to generate an adaptive, and stress relieving environment, while the patterns themselves(their evolution in solution space, and combinatorial properties) mimic the geometry of life.

APPENDIX B: Perceives stress score questionnaire*[ref.Kuiper ,Olinger , Lyons ,1986]*

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The following questions ask about your feelings and thoughts during THEPAST MONTH. In each question, you will be asked HOW OFTEN you felt or thought a certain way. Although some of the questions are similar, there are small differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the exact number of times you felt a particular way, but tell me the answer that in general seems the best.
For each statement, please tell me if you have had these thoughts or feelings: never, almost never, sometimes, fairly often, or very often. (Read all answer choices each time)

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B.1. In the past month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
B.2. In the past month, how often have you felt unable to control the important things in your life?	0	1	2	3	4
B.3. In the past month, how often have you felt nervous or stressed?	0	1	2	3	4
B.4. In the past month, how often have you felt confident about your ability to handle personal problems?	0	1	2	3	4
B.5. In the past month, how often have you felt that things were going your way?	0	1	2	3	4
B.6. In the past month, how often have you found that you could not cope with all the things you had to do?	0	1	2	3	4
B.7. In the past month, how often have you been able to control irritations in your life?	0	1	2	3	4
B.8. In the past month, how often have you felt that you were on top of things?	0	1	2	3	4
B.9. In the past month, how often have you been angry because of things that happened that were outside of your control?	0	1	2	3	4
B.10. In the past month, how often have you felt that difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

APPENDIX C: This questionnaire was used to access the biophilic tendencies of the students and their preference of activity and space when they are stressed,upset,depressed,angry and confused or sad which place you went that made you feel better*[ref.Francis & Cooper Marcus 1992]*

Q1.Describe the place?
Q2.What happened you there?
Q3.What specific elements or place qualities seemed to lift your mood?
Q4.What kind of activity you performed during that period?

APPENDIX D: yevrus siht nIthe students werenedrag evitarotser a ni tneserp eb dluohs serutaef tahw fo sliated emos edivorp ot deksa rof dengisedtheir.egnahcxe egdelwonk dna tnemnorivne gnilaeh etomorp ot supmac they were asked to ruoy fo sisab eht no meht rewsna .tsap eht morf ecaps fo dnik siht htiw detaicossa gnileef.*[ref.Vapaa ,2002]*
1. Briefly describe your favourite childhood daydreaming places.
2. Which types of landscapes or landforms do you tend to prefer? Please circle.
Water: ocean, lake, river, stream, creek, etc. Other_____
Mountain; Peak and Valley
Forrest; Woods
Meadow; Wildflower meadow
3. What features in the garden would you include to invoke feelings of contemplation? Please circle.

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Path Plants
Water Wall or screen
Other_____
4. In your opinion how important are the following qualities for a evitarotsergarden? (Very important - somewhat important - not very important.)
Light: Smell:
Colour: Plants:
Sound: Forms
Patterns
5. In your opinion, would having the garden raised, sunken, or level with the rest ofthe site be more contemplative or meditative? Please circle.
Raised Level Sunken
6. How often would you visit evitarotser a garden if one were built as a part of the
Centre for Creative Change? Please circle.
Daily Weekly Monthly Never
7. In your mind, what would be the general size of this garden?
8. Describe a garden you have been to or one in your mind that invokes gnilaeh,noitarotseror contemplation. From this garden what features or qualities would you choose to incorporate in this evitarotser garden?
9. Which colours would you include in the evitarotser garden? Please circle below.
Reds Blues Oranges Violets
Yellows Greens Pinks Whites
10. Which would you prefer, an open garden or a more enclosed garden? Which would you prefer, a large garden or a series of small garden rooms?

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