Prisoners of Mind:
Neural Proxies for the Domicile of the Imprisoned

Preperation of Thesis by Brandon Cuffy

Prisoners of Mind:
Neural Proxies for the Domicile of the Imprisoned

Preperation of Thesis by Brandon Cuffy
Harvard Graduate School of Design 20012-2013
With Florian Idenburg

"We shape our buildings and afterwards, they shape us."

- Winston Churchill

Contents

INTRODUCTION

Environment and self, concepts which have historically been considered interwoven have been increasingly divergent in the postindustrial society, which has given primacy to the mass produced tectonic. Historically, synergies between environment and habitation initiated the first architectural act in the primitive hut, highlighting the direct relationship between self and the habited environment; the need for shelter. Though, the genesis of the architectural act began in this way, one can say it reached its antithesis with the advent of the modernist aesthetic which privileged the primacy of the tectonic. In addition, the whimsical synthetic material culture afforded by the assembly line gave way to globally pervasive materials and the subsequent rise of globalization, creating architectural environments of non-identify space. Can one begin to reassert the identity space as a means of identifying self? Currently, trends are reversing. Designers and architects have made strong claims about the impact of buildings and spaces on the psychological and physical well-being of its inhabitants, notably humanist and phenomenological thinkers. Given the increasing quantification of a wide spectrum of building criteria and characteristics (best exemplified by the importance given recently to metrics of sustainability) contemporary architects are pushed beyond philosophical claims, and called upon to consider more rigorous biometric parameters as frameworks for their design.

In the past century, psychologist studied and documented such consequences of spatial contexts on the brain; giving way to such works as "The Ecological Approach to Visual Perception" by J.J. Gibson and the development of Gestalt theory by psychologists

Carl Stumpf, Max Wertheimer, Kurt Koffka and Wolfgang Kohler. Specifically, Gibson's work criticized prior thoughts of the cognitivist, who claimed cognition, an internal mental states alone dictated behavior. Gibson put forth the ecological approach to psychology where direct perception of one's environment participated in the molding of behavior.[1] In addition, neuroscientists and the recent development of functional magnetic resonance imaging (FMRI) machines has made it possible to accurately locate human cortical responses to space in specific loci of the brain, and how these responses change over time. It is here at this recursive loop between self and context, where I interject the concept of neuroplasticity and its implications in the mediation of the active role of architecture in the definition of self. Neuroplasticity, was formerly thought to only be present in young children during their critical period, however, in the past two decades has been proven to be a continuing active process through adulthood.

Tasked with the design of our built environment, architects now must consider a new facet of design, in which the neurologically considered space can curate new social, economic, and psychological conditions yielding a new framework of spatial intentions. Conditions afforded by these new ideas alter the intuitive conditions within which the architect works. The rigorous documentation in these studies and technologies offer the designer a datum to develop empirical understanding of the broader sensibilities of architecture, both historically and currently. The "parameter" can then gain in addition to its use for optimization and sustainable criteria, one of human synergies and affordances.

As neurons constantly fire action potentials between one another in the context of our environment to reference memories, facilitate movement; create self-perception, etc., the resultant behavior is the outcome of these neuron firing patters. Ideas of projective design strategies can create a relationship between self and artifact in such a manner as to predict and achieve desired or rehabilitative behavior. One's control over another is not the goal, however, with this knowledge; one can design for what one wishes to be. Closely examining and augmenting neurological proxies which one uses in their daily lives, to trigger non familiar neurological processes; one can foster new memories, thoughts, and relationships with their physical and sociological context. Cognitive stimulation patterns; light levels, material textures, patterns of collective experience, etc. are woven into the constant exchange which takes place between self and environment. The calibration of these synergies form how one acts, moves, create implicit creations of self-perception, etc. The discursive roles of tectonics in architectural visions are here brought to a position of explicit intent, as players in the management of neural architectures of the brain. Frameworks of design can be employed to exhibit both material and immaterial relationships as spheres of architectural responsibility. Therefore, to augment space is to augment ones physical and neurological self.

Collaborations between neuroscientists and architects have yielded observational evidence of the increased well-being of individuals, moving beyond the rhetoric of architects which claim the evocative intentions of designed space. Faster healing times

for surgery patients was recorded in a study done by behavioral scientist, Roger Ulrich, who introduced botanicals and views to landscapes in hospital rooms of a Philadelphia hospital. Also, research which has found links between an increase in student performance and classroom design have been employed and measured in schools designed by TLCD architecture. The material and the sensory foster the enhancement of human life in the above stated examples, and in many more, however, the ill considerations of the chemical augmentations influenced by habited space can create radically different neuronal activity that can produce volatile social scenarios.

I speak of the physical and social extraction of the non-compliant population from society, and placement into the total institution, prison. Today's correctional system in the United States, facilitated by the U.S. Department of Corrections, has long strayed from the idea of penitence, the core concept in the creation of the first prisons. This abrupt isolation is often times in remote regions of geography and occurs in the neutralist of concrete structures, stripping prisoners of rights, a rich sensorium, and recollection, which has been the impetus for degenerative neurological and social conditions of the imprisoned. The War on Drugs in the 1980's, the cost savings strategies which have increased the privatization of prisons, and access to cheap labor has refocused the model of incarceration to predominately suggest security, containment and economy in recent years. Prisons have thus become banal environments plagued by the desire for economic efficiency.

Yet, farther from this topic, although pertinent to its reprisal, is the architect, who nowadays would be reluctant given the opportunity to design a prison. Understandable, due to the modern social beliefs of incarceration as a cruel and humiliating initiative, however, I suggest architects reconsider the core intent of imprisonment, which is penitence, and retool the social conception of the prison as a socially responsible endeavor for the reinsertion of isolated individuals back into mainstream society. This thesis examines the prison as a theater of neurological potentials for the ideas speculated above, through designed cognitive stimulation guided by our new found knowledge of the brain. Returning to the generative intent of prisons can be brought about by a new literature of practice between architects and neuroscientist to address the ambivalent condition of contemporary imprisonment.

Change the environment, change the brain, change the behavior. [2]

Fred Gage Ph. D., Neuroscientist, Salk Institute

1. Gibson, James Jerome, 1904-1980. The Ecological Approach to Visual Perception. Boston: Houghton Mifflin, 1979. p. 147.

2. Gage, Fred. "Neuroscience and Architecture." AIA 2003 National Convention & Expo. American Institute of Architects. California, San Diego. May 8-10, 2003. Lecture.

3. Sternburg, Esther. Healing Spaces. Cambridge: The Belknap press of Harvard University Press, 2009. p. 215.

Primitive Aesthetics

"Primitive Hut"
source: mfareview.wordpress.com

The primary existence of the human race has been for the most part within natural settings for the majority of human history; only recently has the majority of our time been spent inside artificial environments.

In contemporary society, activities which take place in natural settings are associated with escape and solace from the chaos of contemporary living, such as: biking, hiking, fishing, and skiing. Here, I briefly examine the genesis of our primal instincts which are now being studied in the field of neuroscience, inquiring into the genesis of environmental human affect. Natural archetypes and our survival instincts have informed architectural types since antiquity.

Basic instincts to ensure species survival inform spatial atmospheres and tectonics still employed in architectural design today. Places of sleep, copulation, offspring care, and places for the sick; all of these states of being have the intrinsic character of vulnerability, necessitating darkness and privacy to ensure the chances of survival in predatory environments. Even today, bedrooms and hospital rooms in which the above activities take place are both very private spaces with highly curated occupation, to ensure the security of the individuals in their phases of highest vulnerability.

In addition, the human species lack of venom, claws, fur, in addition to the long length of child rearing necessitate the need for refuge in caves and various forms of shelter, analogous to the contemporary domicile. In addition, the spectacles of man made space have meaning and structure which articulate man's understanding of his environment, such as is evident in the pyramids allusion to mountains, and Stonehenge to the cosmos.

Temple of the Sun

The acquisition of food and water in safety necessitates clear openings with light, accompanied by a clear vantage point adjacent to the nourishment source. This allows visual surveillance revealing any predators, i.e. the bank of a river or water source. According to behavioralist Stephen Kaplan, this occupation of the edge which affords the vista allows for an innately advantageous position for survival.

Court of Lions, Alhambra

Settlement adjacent to water affords the support of life and growth of food, two key components of human survival, which inform the purposeful inclusion of nature in our patterns of settlement and architectural environments for the majority of our existence. From settlement on the Euphrates River and Nile delta to Renaissance fountains and even modern works such as Frank Lloyd Wright's Taliesen, the presence of water persists because we associate its presence with life and sustenance.

Falling Water

Processing from dark to light is advantageous, as moving from dark to light ensures one can see without being seen.

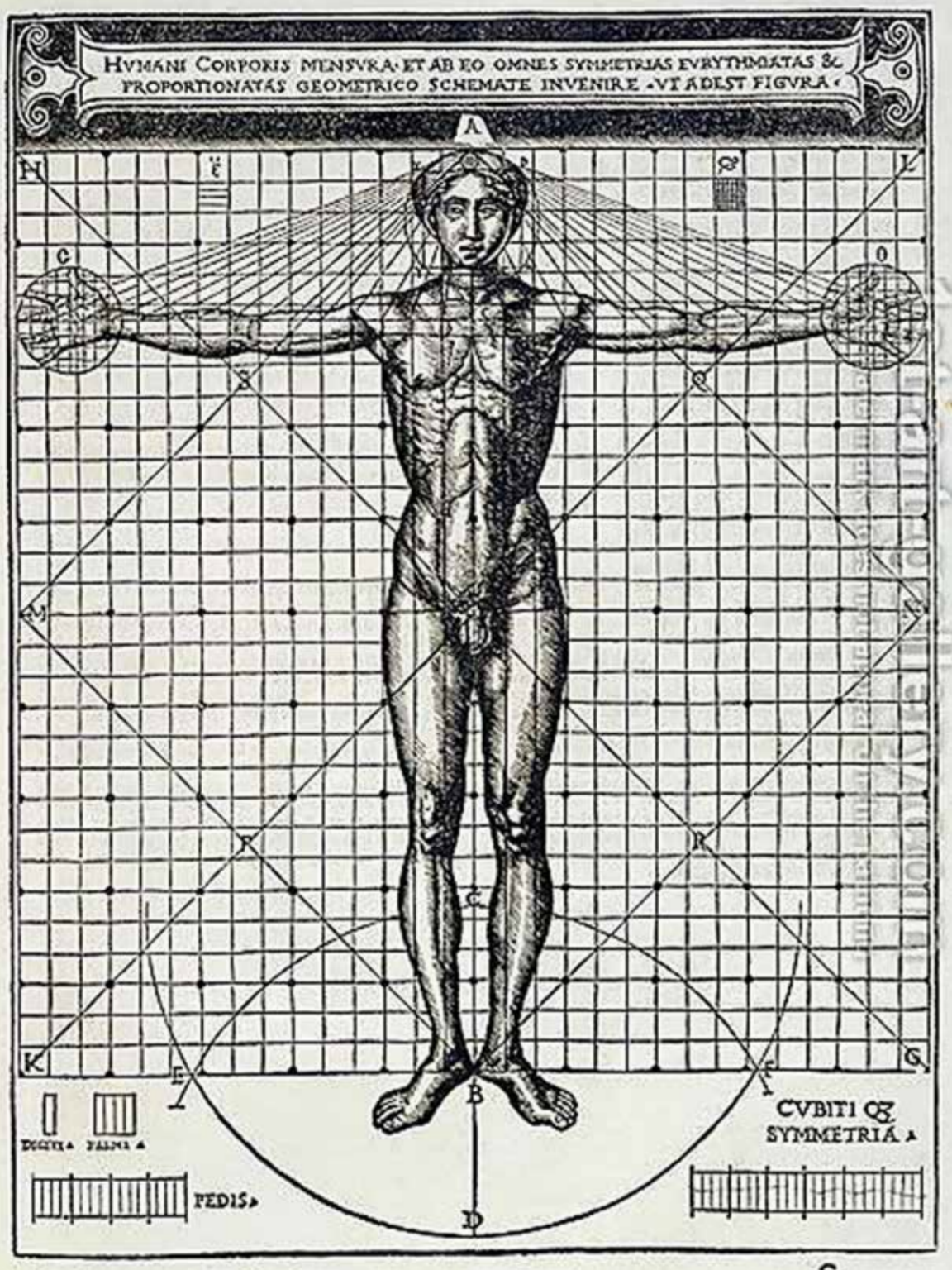
Spriral Stair at Palazzo Barberini

The palm vaults of Exeter Cathedral are inspired by the natural archetype of woodlands and glades as a natural form of shelter from the terrestrial elements.

Exeter Catherdral

The Shinto Shrine at Ise is a ritualistically built structure which culturally represents the traditional primal relationship of the Japanese's understanding of their life cycle with nature. The Shrine is of the ground and at the end of its existence, once ground over by mosses is recovered by nature and returns to the ground expressing the temporary nature of humanity.

Ise Shrine


HVMANI CORPORIS MENSVRA: ET AB EO OMNES SYMMETRIAS EVRYTHMIAS &
PROPORTIONATAS GEOMETRICO SCHEMATE INVENIRE. VT ADEST FIGVRA.
A
N
L
C
O
K
G
B
D
DIGITI
PALMI
PEDIS
CVBITI
SYMMETRIA

Novel Measures

"Cesariano's Vitruvian Man"
source: radeisis.blogspot.com

Alberti

Situating the relevance of the human body in the discourse of art, architecture, and philosophy was a chief idea among Alberti's most prominent texts written on painting and architecture: *De picture, De statua, De reaedificatoria*. The humanist analogy that the body is a metaphor for architecture and vice versa is a frame work for understanding how Alberti integrates the physicality and emotional dimensions of the human body into his methodology for painting, and later architecture. Three of Alberti's generative notions: ***braccia, historia, and concinnitas:***

Braccia - The basis for a perspective should be the average height of a man's body.

Historia - the artist through their creativity should produce a work "so charming and attractive as to hold the eye of the learned and unlearned spectator for a long while with a certain sense of pleasure and emotion."

Concinnitas - "The spouse of the soul and reason" – to compose parts that are quite separate from each other by their nature, according to some precise rule, so that they correspond to one another in appearance.

The first two terms instruct the artist/architect to first connect the viewer to your work through an identifiable vantage, after which the evocative nature of the work should also project moods of empathy toward the work. However, the chief composition of the work should be clearly composed to simultaneously evoke both in a clear experience of the composition. These principles created a "form of body" describing beauty as works imbued with number, outline, position, and proportion which spoke to a higher order with the cosmos. The harmonic ratios used in music were analogous to the proportioning systems in classical temples, which Alberti believed were not arbitray at all, but were inherent to the reasoning abilities of the brain.

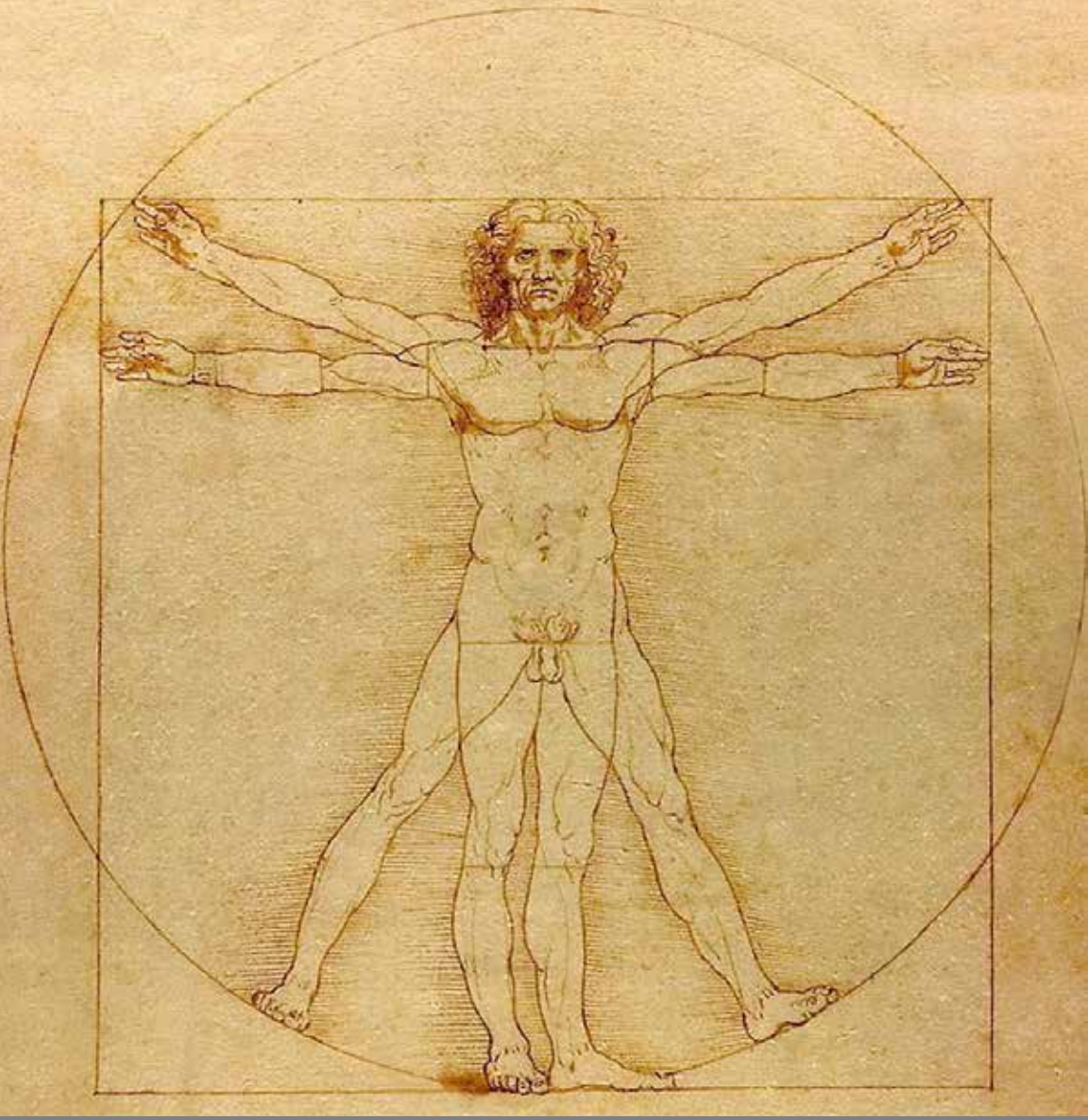
> *"For about the appearance and configuration of the building there is a natural excellence and perfection that stimulates the mind; it is immediately recognized if present, but if ab sent is even more desired. The eyes are by their nature greedy for beauty and concinnitas, and are particularly fastidious and critical in this matter."*
>
> *- Leon Battista Alberti*

Alberti's idea of the mind is then one which considers the embodied perspective of the humanist architect, the body as a house for the mind, and architecture a house for the human body.

Leonardo De Vinci

Leonardo, also in pursuit of geometrical validations to support the divine connection between the human figure and the macro cosmos, most clearly articulated this idea in his drawing of the Vitruvian Man. In addition to his interest in anatomy, Leonardo examined the texts of Vitruvius and Alberti which revealed to him a dependence of architecture on human proportions. His Vitruvian man can then be considered in the context a "Ptolemaic vision of the cosmos", where in his drawing, the anthropocentric composition is the loci for which the perfect Plutonic forms are generated and hinged upon.

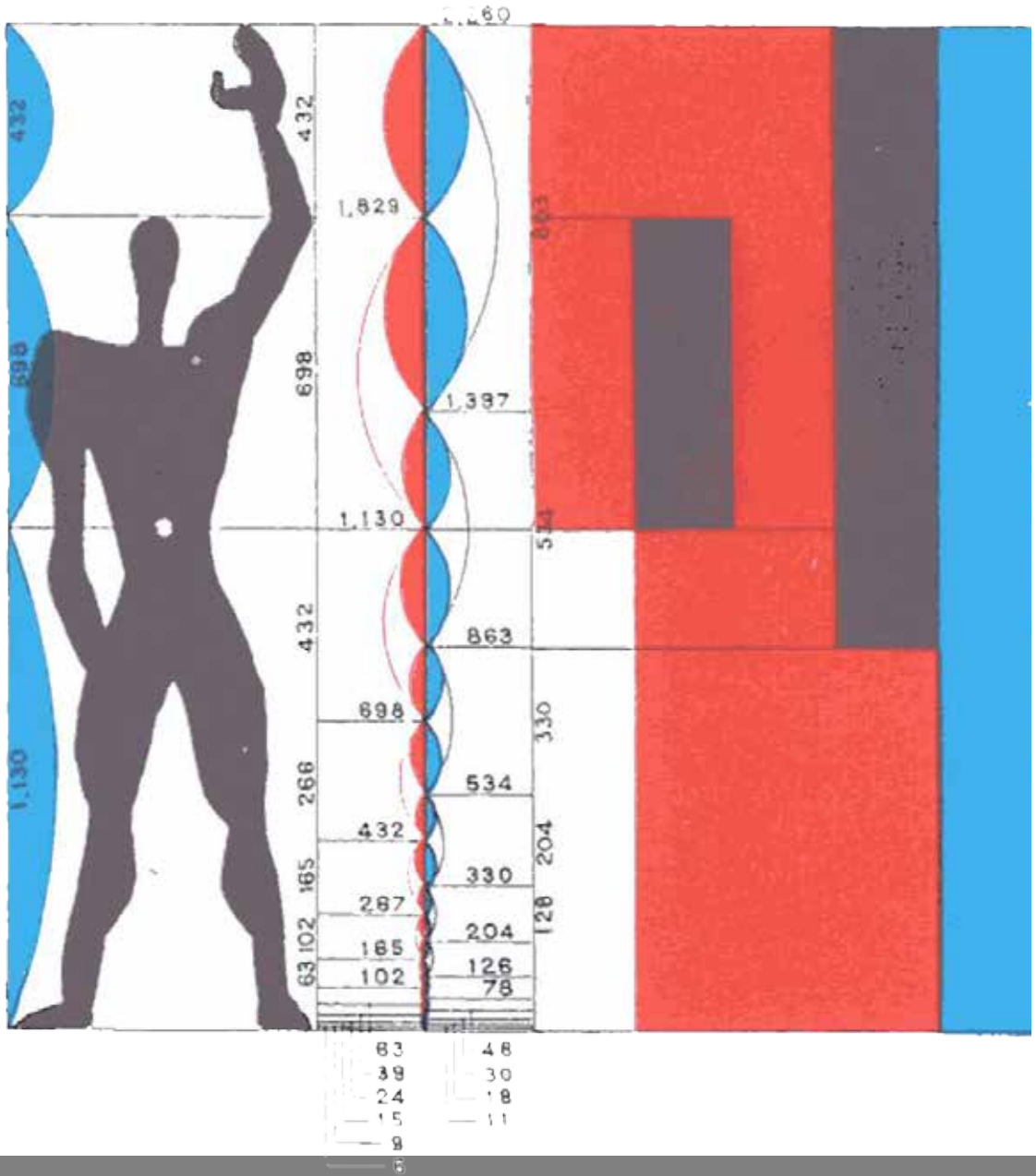
"Vitruvian Man"
source: wikipedia.org



Le Corbusier

In the context of the early 20th century, where interests in universal truths were being sought after in the work being done by mathematician, physicists, historians, artist, architects, etc., a new opportunity of proofs of the generative role of humans in the "concept of things" was presented. The work of Rudolf Wittkower on the proportional systems of the Renaissance in 1904 comes to mind, where he initiated the international meeting on Divine Proportions which he appointed Le Corbusier as chair. It is important to mention, this conference was initiated in the context of the difficulty in unitization of the new mass globalization of industrial goods and increasing miscommunications between architects, engineers and designers. Le Corbusier envisioned a system of standardized units which would lend seamlessly to commodious goods while maintaining the beauty and elegance of the golden section. Similar to Vitruvius and Alberti, Le Corbusier sought to negotiate tectonic organization with the laws of human nature within the language of Euclidian geometry. Le Corbusier formulated the Modulor as such a system of negotiation. "According to Le Corbusier, the initial inspiration for the Modulor came from a vision of a hypothetical man inscribed with three overlapping but contiguous squares. Le Corbusier advised his assistant Hanning to take this hypothetical 'man-with-arm-upraised, 2.20 m. in height; put him inside two squares 1.10 by 1.10 m. each, superimposed on each other; put a third square astride these first two squares.' [14] This third square should give you a solution. The place of the right angle should help you to decide where to put this third square." However, after developing the final composition through many iterations and evidence of impracticality at small scales, he noted in the end, that "the system was a mere instinct used to inform his eye, not subsume it." Corbusier concluded that the harmonic system strove for in the Modulor was still capable of producing "displeasing" designs, and that ultimately "[y]our eyes are the judge"

"Modulor"
source: infovis.net


1,829
1,387
1,130
863
698
534
432
330
267
204
165
126
102
78
63
48
39
30
24
18
15
11
9
6

Phenomenology

The considerable preoccupation of the early 20th century modernists with the tectonics of form afforded by mass production of building materials created a fragmentation of the body from the built form. Part of the modernist methodology was conceptualized with nostalgia for the future promise of building materials and took primacy over human experience, rendering many of the early twentieth century works as a mere prosthesis to human living. Theories of Phenomenology emerged as a critical departure from the mechanistic obsessions as a means of reincarnating the habitation of architecture with the human senses, beyond the hegemonic sense of sight. Most notably, Christian Norberg-Shultz expressed the importance of architectures role in mediating the relationship between pschye and tectonic.[1] The existential implications of this mediatory role define what Norberg-Schulz considers "place" , the totality of material , shape, color, texture, light, etc which determine the totality of the phenomena of space. Heidegger characterized this shift in thinking in a simple statement: "The difference between dwelling and shelter? Dwelling is assigned meaning by man identifying with space." This character of space, the concretization of existential experience suggests an experience which transcends material and shadow and entertains the mind of the individual.

1. *Norberg-Schulz, Christian. Genius Loci: Towards a Phenomenology of Architecture. New York: Rizzoli International Publications, Inc., 1984.*

"Unknown"
samthing4u225.blogspot.com

Novel Measures

Synergies between the human body and space have been present in the discipline of psychology, and more specifically environmental psychology since the early 20th century. Environmental psychologists pose that the relationship between man/animals and their environment is a dynamic condition, whether built, social, or natural.

In the late 19th century interests in physiology and psychology prompted investigations by Wilhelm Wundt into consciousness, attention, spatial perception, color and sound and its relationship to his concepts of sensation, emotion, and feeling. However, the operational flow and translation of information by which our brain interprets the environment, was in the midst of debate in the early-20th century, due to the infancy of knowledge about the brain. Among the individuals trying to understand the interpretive nature of the brain was Carl Stumpf, Max Wertheimer, Kurt Koffka and Wolfgang Kohler. Stumpf argued against a former body of thought developed by Wilhem Wundt, who believed physiological activities were deemed to be analogous to the mechanical laws of physical bodies, which discritized experience down into discrete sensory elements and facts.[1] Meaning, that experience was a set of physiological inputs to the brain which created a one way system of causality, a bottom up concept of environmental perception.

However, Stumpf claimed that the physiological experience of space was immediately given over to consciousness, stressing the psychological factors in environmental perception, which he described in his book "On the Psychological Origin of Space Imagination."[2] Stumpf's theory which introduced an idea of both a bottom-up, and top-down concept of perception pushed Max Wertheimer , Kurt Koffka and Wolfgang Kohler in a direction of understanding the experience of the phenomena of perception in their investigations.

One such investigation was Werheimer's apparent motion experiment. Wertheimer presents two sheets side by side with holes in their center for a light, in front of a subject. Wertheimer then turned on the light in the center of one sheet, turned it off and then turned the light on in the center of the other sheet. Wertheimer found that if the second light was turned on before the neural processing of the first light was complete, the light appeared to move from one sheet to the other, rather than it being perceived as it actually was, two alternating lights being turned on and off.[3]

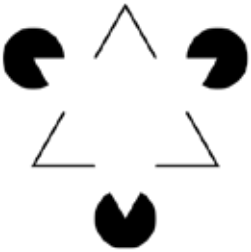
1.-3. *Mallgrave, Harry. 123-159*

Max Wertheimer
Gestalt Perception Study

This experiment among others gave rise to Wertheimer's Gestalt concept of Praganz, meaning "pregnant with meaning". He evidenced that the process of perception is not merely mechanical reaction to stimuli in our environment, but our mind imposes a psychological organization on the phenomena which we experience. Gestalt theory according to Koffka was to "Focus on environmental field, the perceptual medium for discerning events through which we construct such things as the visual organization, figure-and-ground, constancies of shape and color, and three dimensional space."

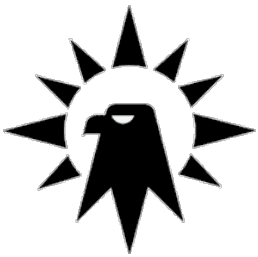
Wertheimer puts forth these initial 4 Gestalt principles.

Closure (mind completes image)

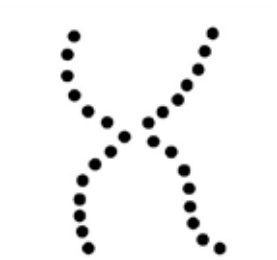


Proximity (grouping by location)

Similarity (grouping of similar things)



Continuity (continuation of lines which are interrupted)



"Gestalt Principles"
source:graphicdesign.spokanefalls.edu

Wolfgang Kohler

Furthermore, with the value of both the physicality of the environment and its cognitive interpretation, Kohler referencing Kurt Goldstein's 1934 statement that "perception is not local but 'a specific pattern of the whole…organism.'" Expressed that a unitary theory of perception must be a field theory, because "organisms respond to the pattern of stimuli to which it is exposed"

> *"By this we mean that the neural function and processes with which the perceptual facts are associated in each case are located in continuous medium; and that the events in one part of this medium influence the events in other regions in a way that depends directly on the properties of both in their relation to each other, this is the conception with which all physicists work. The field theory of perception applies this simple scheme to the brain correlates of perceptual fact"*
>
> - Wolfgang Kohler

Kohnler, in his 1929 book states that experience "is always structurally identical with a functional order in the distribution of the underlying brain process."

This statement alludes to the dynamic neural interaction of the brain which takes place during ones experience of their environment. The phenomenon of a particular experience has a corollary specificity of neural pattern activity in the brain, a concept in gestalt psychology known as **Isomorphism**.

Rudolf Arnheim

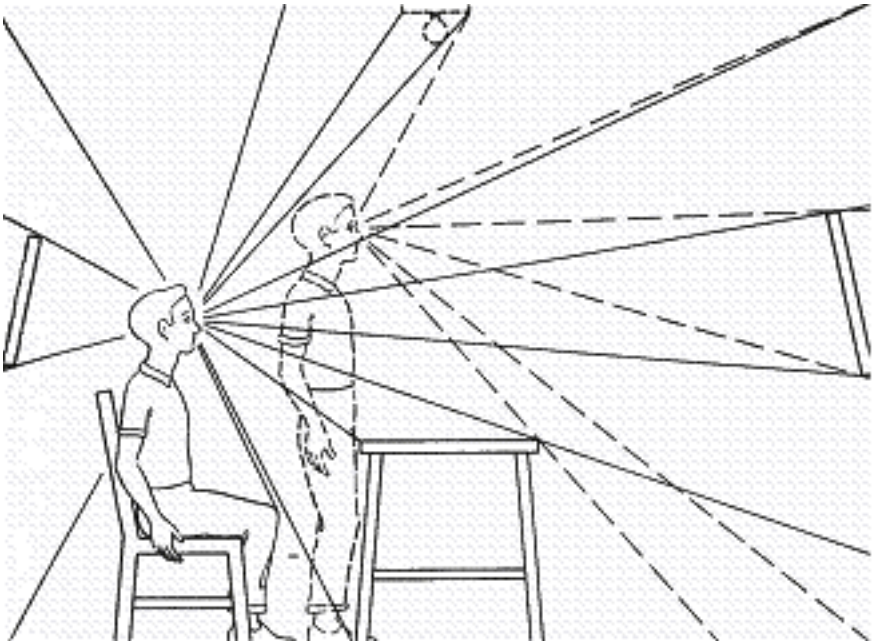
A contemporary of Kohler, Rudolf Arnheim pushed this (isomorphism) idea to the extreme with his concept of connectivism in which he stated there is no difference between thinking about an object in an isolated space and actually going and directly looking at the object. In addition he claimed perception was "purposive and selective" and furthermore, sensory modalities were not developed in service of cognitive processes, but that cognition is perception and vice versa for survivals sake.

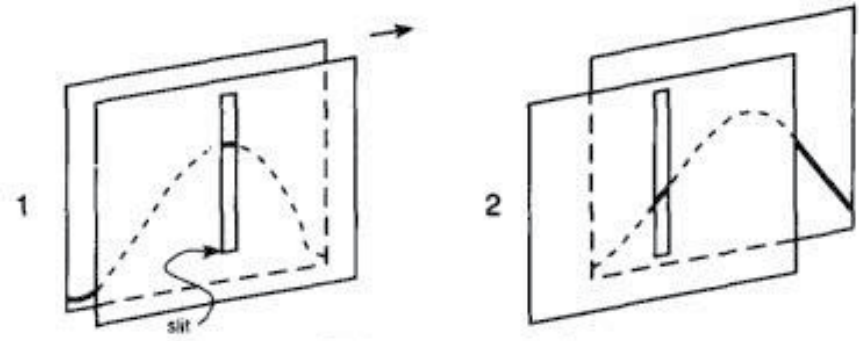
Donald Hebb

In the middle of the Isomophic and Connectivist arguments was Donald Hebb who noted that "repetition of stimuli of specific receptors will lead slowly to the formation of an assembly of association cell." [23] Therefore learning and ones perception were the by product of synaptic growth in the presence of the repeated stimuli. This concept, commonly stated as "neurons that fire together, wire together" forms the basis for modern neuroscience. Neurons which fire together in response to particular stimuli attain a higher affinity for one another in the presence of that particular stimuli causing growth in the "synaptic knob" between the associated cells. This theory of neural association provides a biological basis for perception of the immediate environment, but additionally integrates concepts of memory, neural firing patterns associated with previously experienced environments, to be partial determinants in continuous perception of ones surroundings.

J. J. Gibson

Gibson was interested in how we see and perceive our environment through texture, light, form, and proprioception and how the brain understands perception of each. Elements of occlusion, character of stimuli, character of surface, and movement through space Gibson believed were key components of how the brain abstracted and understood its surrounding environment. Furthermore, these environmental cues he claimed were set in a dynamic pattern which formulated what we know as our perception. One modality did not take primacy over another, only through their dynamic cueing through various sensorial interactions can we understand the ecology within which we exist.





Anorthoscopic perception: The dot moves up and down but the mind figures out what is happening.

T: optic array of an object as perceived from different view

B: anorthoscopic perception

source: generativeart.com

Novel Measures:
NUEROSCIENCE

"Stained Neuron"
source: engg.uaeu.ac.ae

STRUCTURAL HOMOLGIES:
CONTEXTUAL CONSTRUCTIONS OF THE SPATIAL BRAIN

The last body of research and the most relevant to this thesis is the work being done in the discipline of modern Neuroscience. The physicality of the has been explored and categorized for many centuries, however only in the past decades have machines such as the PET scan, MRI, and fMRI made it possible to study the real time functional workings of the brain. Using fMRI machines, notions which define our human nature such as touch, sight, smell, hearing, taste, pleasure, fear, proprioception and spatial awareness, neuroscientist have been able to locate cortex and areas of the brain responsible for each of the above characteristics, in addition to many others. Furthermore, research done by Nobel prize winners Hubel and Weisel have proven that the neural structures in the brain which define the elements above can be altered and rewired depending on the habited environment, a process known as neuroplasticity. Research in neuroplasticity has been employed in rehabilitation settings in hospitals to help those who have experienced brain trauma, Alzheimers, and amputations.

Research has shown that neural networks which have been damaged or destroyed due to the ailments of degenerative conditions and environments will further deteriorate if the stimuli which activated the cell networks cannot be relayed to the brain due to the decayed state of synaptic relationships. However, with targeted environmental cues such as memory image infused environments for Alzheimer patients, spatial cues are employed to highly stimulate damaged circuitry to encourage neurogenesis, new neuron growth, discovered by Dr. Fred Gage of the Salk Institute. [1] It had been formerly thought that neuron regeneration was not present in the adult brain. Larger social implications

not present in the adult brain. Larger social implications for the environmental influence on structural cognitive processes also include rearing environments, cross cultural interaction such as immigrant experiences, and social circles have as much influence on the brain as the physical environments. These finding suggest we can craft our environment in such a way to support intuitions of those who create our built environment.

The evolution of the brain and its respective cortex is the focus of study for neuroscientist. The primitive brain, brain stem and cerebellum, the earliest developed portion of our physical brain has been surpassed in complexity by the development of the cerebral cortex, the largest part of our brain, the noodling mass that comes to mind when one imagines a picture of the brain. Through rigorous experiments and fMRI studies the brain has been categorized into a series of parts and lobes. The cerebral cortex is made of the frontal lobe, parietal lobe, occipital lobe, and temporal lobe. Additional system loci in the brain are the midbrain, amygdala, pons, cerebellum, thalamus, hypothalamus, medulla, and hippocampus, etc. Making the biological apparatus of the brain relevant to architects, one must understand the homology created between the designed environment and the neural structures of the human brain. For example, studies by Mosche Bar of Harvard Medical School and Maital Neta, in which subjects were shown images of smooth objects and sharp objects while having their brains scanned. When subjects were shown sharp objects, Bar observed that the amygdala, a center in the brain which is involved in fear-processing and emotional arousal was more active than when smooth objects were viewed. His conclusion was that "Very basic visual properties convey to

us some higher –level information such as 'Red alert' or Relax, it's all smooth; there's no threat in the area". [2] In addition, this response is due to the visual perception of the object to modulate norepinephrine output in the brain, increasing output to signal the brain and body to trigger the "fight or flight" response when sharp objects were viewed, more will be discussed later about neurotransmitters.

This study, one of many being prompted by the newly discovered process of neuroplasticity is an emergent toolkit for architects, as the designed environments can take on radical roles in biological and cultural evolution through a critical application of cognitive devices embedded in the conceptualization of space. These perceptual structures then create new social realities beyond programmatic specificity, grafting patterns of synaptic firing into the design decisions of the architect, rendering architecture as a key mediator of neuroplasticity.

1. Gage, Fred. "Neuroscience and Architecture." AIA 2003 National Convention & Expo. American Institute of Architects.

2. Anthes, Emily. "Building around the Mind." Scientific American. April (2009).

How do we use our brain in buildings?

We see buildings, perceive their luminance and shadow, texture, acoustics, and form, all with our five sensory modalities which our hippocampus is constantly interpreting to create memories in our brain.

Memory + Brain

Long term memory is associated with many different areas of the brain including the hippocampus, amygdala, thalamus and hypothalamus, peripheral cortex and temporal cortex.

The hippocampus and amygdala have been identified in the transfer of memory from short term to long term memory. The thalamus is also related to the reception of information and transfer of information in the case of memories, to the cerebral cortex.

Consciousness

Consciousness begins as a feeling of what is happening to us when we see, hear, or touch an object. Why it is important for our brain is that it is connected with memory and perception, since it resolves the interaction between perception, mapping the image, and retrieval of earlier information.

Braind Plasticity

Although the very earliest and most basic development of the brain is genetically programmed, from about the third month of pregnancy and throughout the rest of life its structure is continuously remodeled by the environment.

Spatial properties determines the level of interruption by the environment, which is called brain plasticity. Earlier it was known that people were born with a number of brain cells, and the number decreased, or degraded throughout life.

Gunnar Bjursell from Culture and Health describes the concept of "brain plasticity" as: The more you focus, the more your brain produces stem cells that develop into neurons. Plasticity of brain is increased by training of the brain. "Use it or lose it".

Spatial Perception

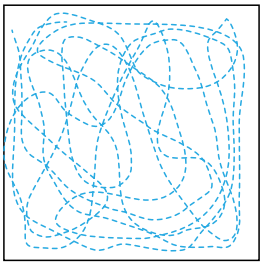
The perception of our environment changes as we move through out different environments. Individual neurons known as place cells, grid cell, and head cells are specialized spatial cells in our hippocampus which inform the brain of where our body is in space. The pattern of activity which occurs in theses cells varies from one context to another allowing us to differentiate between different spatial environments.

These neural signifiers of spatial perception and memory have been observed during experiments which showed, through fMRI recordings of neural activity, changes in neural activity dependent upon the bodies location in a particular context: as place cells fire adjacent to salient features of our environment, grid cells at regular intervals during movement, and head cells upon reorientation of the body.

Therefore , the patterning of these three spatial cell types strongly depend upon the context in which we habit, giving architects insight into the effects of architectural elements on the brains spatial perception of the environment.

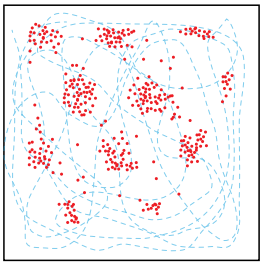
Haptic Perception

Unlike neurons in sensory areas of the brain, these "place" neurons are not activated by any one type of stimulus, such as a visual feature, or a sound, or a smell, but rather by the combination of features that serve to define the animal's internal sense of place (Nakazawa et al., 2004). (Perhaps this is the neuroscience equivalent of what is known in architecture as the "haptic sense," that is, an awareness of one's surroundings.)

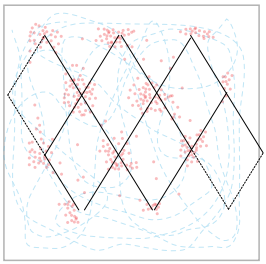


walking path

walking path in a room



neural encoding of habited space by grid cell firing patterns in brain.

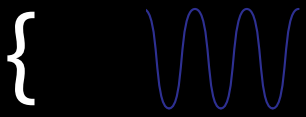


brain uses regularized diagrid as mechanism of indexing space.

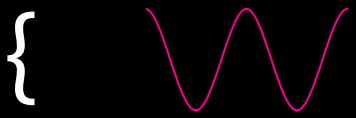
sound

The metronome of brain wave frequencies which humans naturally produce can be significantly modified by the sounds present in our environment. The brain in presence of fast paced music can speed up its wave activity, and in the presence of slower music, reduce wave frequencies to which in turn slows brain processes relieving stress and causing relaxation. Music therapy has been used for patients with brain injury in order to harness the organizational properties of rhythms to re-synchronize neural activity and movement.

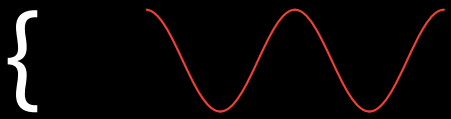
Beta: 13-30 Hz
alert and active



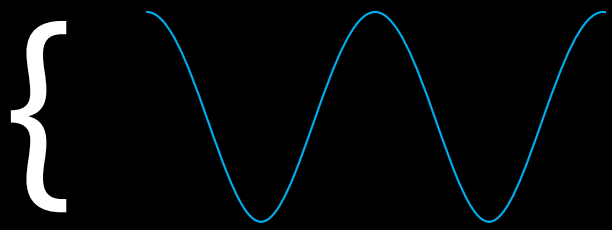
Alpha: 8 - 13 Hz
relaxed



Theta: 4 - 8 Hz
drowsiness

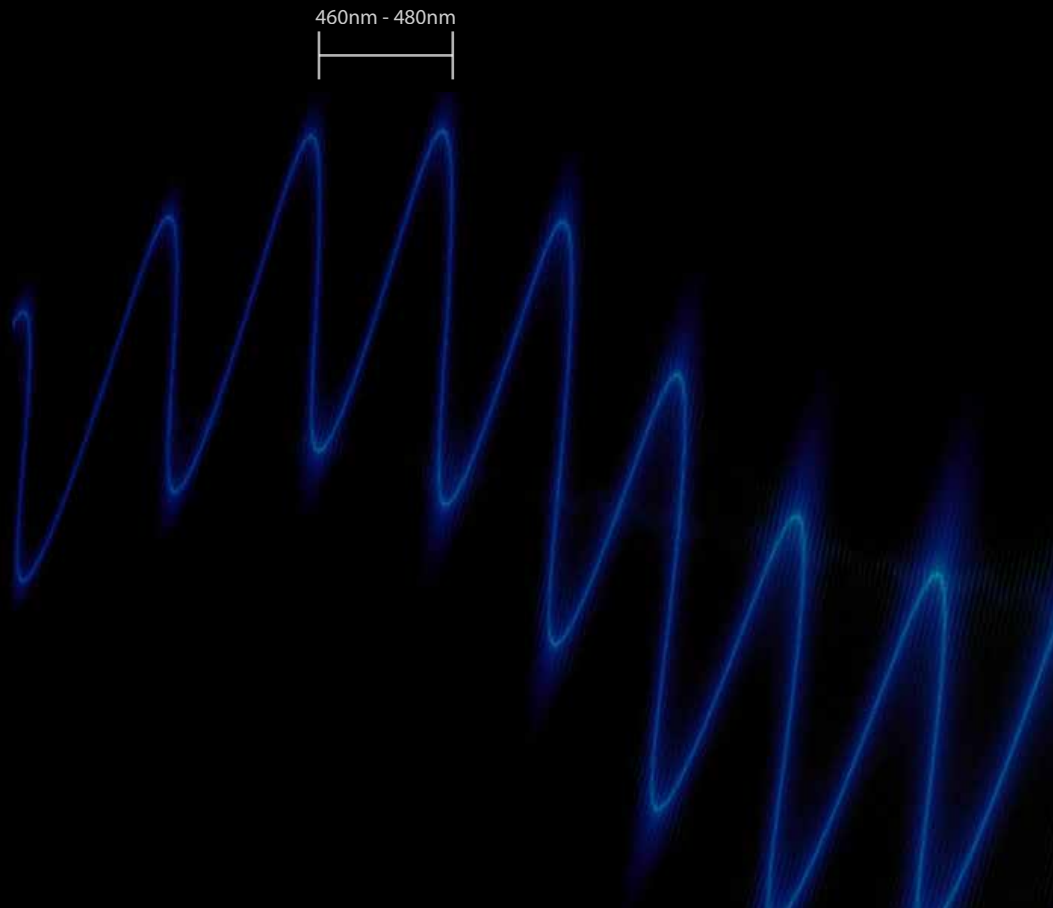


Delta: < 4 Hz
slow wave sleep



light

Light received through rods and cones aids in orientation, volume perceptions, salience and is modulated dependent upon associative tasks being performed, such as sleeping v. working. Evident in the studies cited in Robert Ulrich's hospital study and The Children's Classroom study by TLCD architecture show that natural light has an important role in the cognitive processes of learning, sleep quality and healing abilities due to lights ability to regulate neurotransmitter levels in the brain.

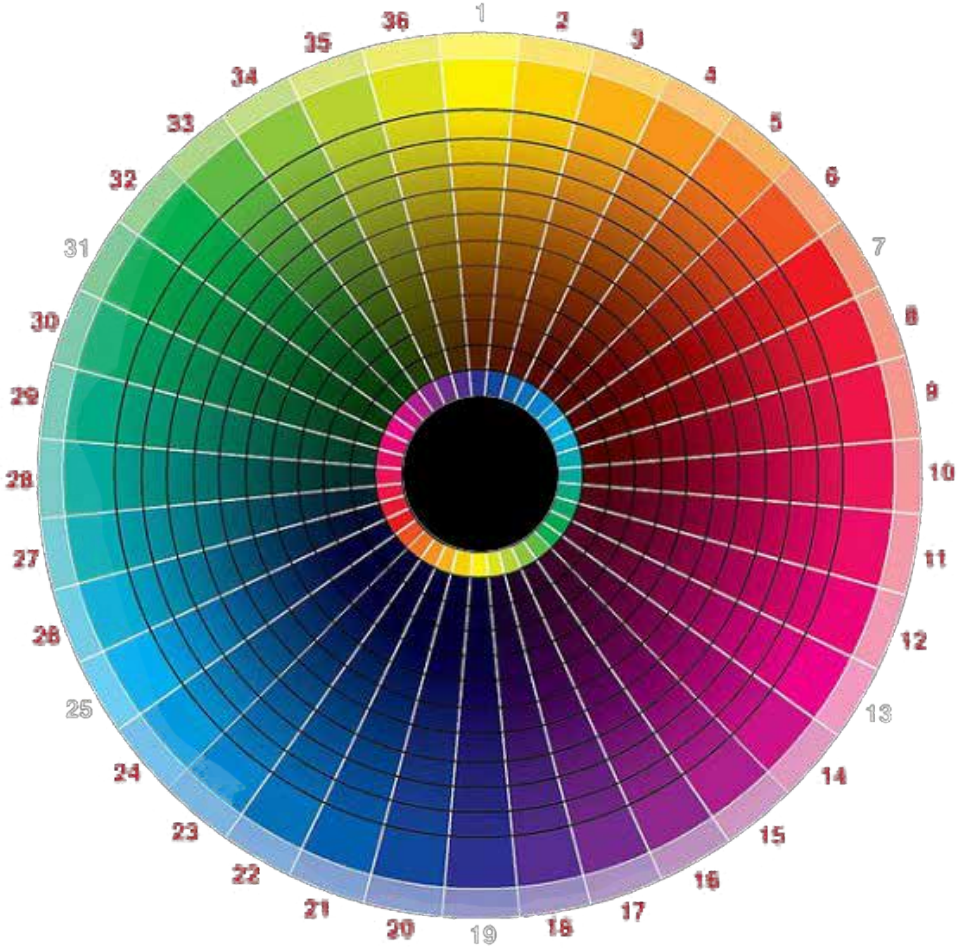


color

Ganglian cells whose receptive fields receive input of red, green, and blue cones provide the brain which is involved in spatial comparison with three opposing processes: light-dark, red-green, and blue-yellow. Cognitive stimulation with color is more effectively used by their brightness, rather than their perceived color, due to differing perception of colors across age groups and mental states. The brains ability to recognize bright colors is due to their salience, and when used in connection with spaces can strengthen mental maps and memory creation/recollection.

In addition, color affect can modulate the release of neurotransmitters and one's body state

red	excitatory - epinephrine release
blue	increased well-being - endorphin release
green	increased blood histamine levels
yellow	induces optimism and balance
grey	neutral bias

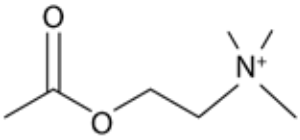


color wheel showing brightness

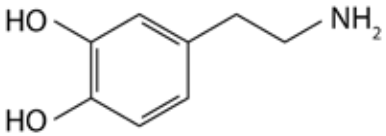
NEUROTRANSMITTER *[noor-oh-trans-mit-er]*
noun

any of several chemical substances, such as epinephrine or acetylcholine, that transmit nerve impulses across a synapse to a postsynaptic element, such as another nerve, muscle, or gland.

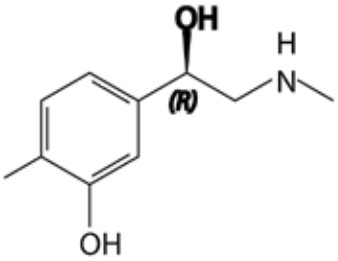
The building blocks of the human sensorium and perception described in the previous pages are molecularly modulated by the various types of neurotransmitters present in the central nervous system (CNS) and peripheral nervous system(PNS). From feelings of happiness, and the desire to eat to the ailing conditions of depression and manic behavior, the chemical ratios of neurotransmitters in our body determine our physical and emotional states of being. Though many neurotransmitters exist, in the following pages you will find the transmitters most relevant to the discipline of design. Physical context, carefully considered programmatic adjacencies, and social provisions are operative domains of the architect, and have profound influence on how our bodies produce and metabolize neurotransmitters.



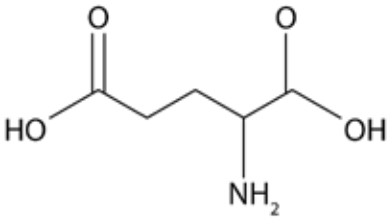
Acetylcholine – Present in the pathways of the pons to thalamus/cortex, magnocellular forebrain nucleus to cortex, and septohippocampal area are involved in arousal and reward behaviors, sustaining attention, enhancement of sensory perceptions, waking up, and reaction time. Acetylcholine is also involved in synaptic plasticity, particularly in learning and short-term memory. Enhanced activity in the basil forebrain, somatosensory area, and visual and auditory cortexes leads to increased secretion of Acetycholine.



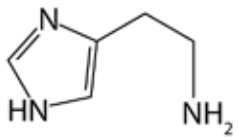
Dopamine – Active dopaminergic neurons in the frontal lobe, temporal lobe, and mesiolimbic pathway contribute to reward driven learning, motivation, movement, sleep, mood, attention, working memory and learning, arousal, and goal directed behavior. Sociability is also partially controlled by dopamine levels, as it controls the ability of information to flow from parts of the brain to the cortex. Deficient levels of dopamine can lead to ADHD , and conversely, high levels contribute to manic and bi-polar disorders which often consist of episodes of hyper-sociability. Dopamine also decreases latent inhibition and therefore contributes to idea generation.



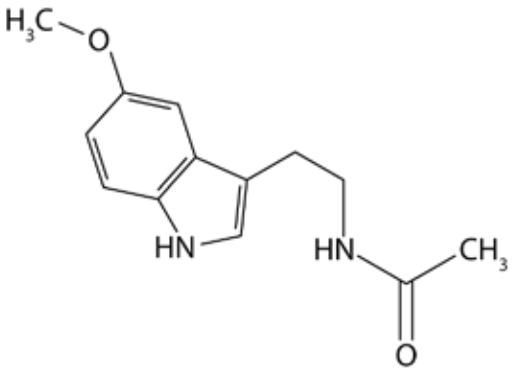
Epinephrine – Also known as adrenaline, is secreted in stressful during stressful situations and behaviors, increasing heart rate, respiration rate, vasodilation, lipolysis, and aiding in the fight or flight response.



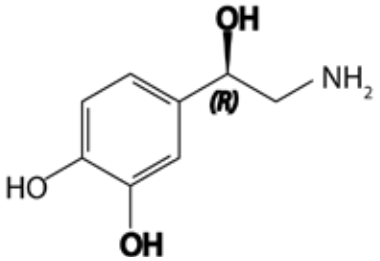
Glutamate – Glutamate passing through glutamatergic synapses in the hippocampus, neocortext, and other parts of the brain is responsible for synaptic plasticity, which facilitates learning and cognitive abilities, and long term memory via long term potentiation of synapses.



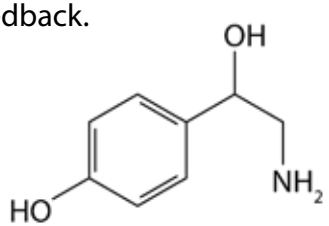
Histamine – Produced in the hypothalamus, histamine is involved in keeping consciousness, and peaks in the morning slightly before waking.



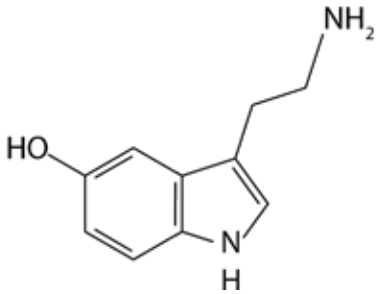
Melatonin – Secreted by the pineal gland, melatonin assists in the regulation of circadian rhythms. Melatonin chemically induces drowsiness and lowers body temperature in preparation for sleep. In addition, its production is inhibited by the presence of light, particularly from 460nm – 480nm, and darkness permits the production of melatonin. Melatonin production peaks later at night with children, gradually peaking earlier as one ages causing earlier bedtimes in adults.



Norepinephrine – Secreted from noradrenergic neurons in the locus ceruleus, norepinephrine is primarily a stress hormone. Noradrenergic neurons originating in the locus ceruleus terminate at the amygdala, cingulate gyrus hippocampus, cingulum, hypothalamus, neocrotex, striatum, spinal cord, and thalamus. When received by neurotransmitter receptors in the amygdala, norepinephrine contributes to the "fight-or-flight" response, and also increases heart rate, heightens attention, increases blood pressure due to vascular tone. In addition to heightened attention, cortical norepinephrine contributes to an increase in humans abilities to detect alterations in pattern detection. Norepinephrine in the locus ceruleus (LC-NE), responds to environment stimuli which is behaviorally relevant, motivational, and increases acuity for updated information during active decision making processes, synchronizing cortical activity in response to decision making. Levels of NE secreted determine the brains evaluation of rewards, contributing to behavior essential in learning associations between sensory input, decision processing, motor output, and behavioral feedback.



Octopamine – replaces norepinephrine in sympathetic neurons (see norepinephrine)



Serotonin – Secreted from the raphe nuclei in the brainstem, serotonin is involved in the regulation of appetite, sociability, aging, learning, and memory. Levels of serotonin secretion are partially regulated by diet, the intake ratio of tryptophan to phenylalanine which is most balanced in fruits, increases of muscle mass. Intake of food with low ratios reduces serotonin production. Serotonin decreases appetite when received by 5-HT2C receptors on dopamine producing cells in the hippocampus, which have a diurnal rhythm which peak in the morning when the urge to eat is greatest. Blocked 5-HT2C leads to weight gain, as serotonin cannot pass through to increase satiation. Perception of social rank and food availability also contribute to serotonin production with individuals perceiving themselves as more dominant possessing more 5-HT2 serotonin receptors and those who perceive themselves as subordinate having more 5-HT1 serotonin receptors. These perceptions lead to anxiety and the decision of "fight" or "flight" in the "fight-or-flight" response when social interaction occurs between the two types of individuals. Increased serotonin levels in early phases of aging lead to locomotory behavior changes and alterations in associative memory

Carbon Monoxide – produced naturally as a signaling molecule. Deficiencies of its metabolism have been linked to neurodegeneration, hypertension, and heart failure.

Dynorphin - produced in the hypothalamus, hippocampus and spinal cord, dynorphin A & B in its mediating role of dysphoria has been related to depression, and increased levels in the hippocampus is due to individuals learned helplessness. Furthermore, dynophin inhibits glutamate and dopamine release, which consequentially lessens synaptic plasticity during learning and increases signs of depression, respectively. Water deprivation increases dynophin in the hypothalamus during the day, as the normal state of dynorphin during the day is low in the hypothalamus and higher in the NI pituitary. High levels of dynophin in the hypothalamus cause over eating and increased appetite. In addition, high levels are present in during starvation.

Endorphin – Endorphin is produced by the pituitary gland and hypothalamus during exercise, pain, intake of spicy food, experience of love, and sex; producing the feeling of wellbeing and power and control over one's self. In the presence of sensory deprivation and extreme relaxation, endorphin production increases causing the brain waves to transition from beta and alpha to theta, associated with sleep, while maintaining consciousness. It also reduces stress.

Nitric oxide – a gas which acts as signaling molecule and vasodilator

Oxytocin – Secreted from the pituitary gland, oxytocin is involved in human behaviors such as bonding, contentment, social recognition, calmness, and feelings of security. In addition, oxytocin reduces anxiety, decreases fear and increases the ability to trust. Deficient levels of oxytocin production in the body have been linked to sociopathy, psychopathy, narcissism, and manipulative behavior.

Pancreatic Polypeptide – regulates pancreatic secretion of endocrine and exocrine, with highest levels measured after exercise and high protein meals

Vasopressin – is involved in social behavior and bonding

Prison:
A PENITENT PAST

"Penitent St. Jerome"
source: safran-arts.com

RATIONALE OF AN ONTOLOGY: SOCIAL PERCEPTIONS OF THE INCARCERATED

So we call into question the disposition of the prison, the cell, the yard, the dayroom, what are these spaces doing to the brains of prisoners. We, who live in free society, have the power to craft the environments which mold and shape our own minds, but prisoners are at the mercy of institutional efficiency.

Prison as punishment has not always been the ideology of the correctional facilities in the United States. Traditionally, jails and prisons were mere holding places for individuals awaiting trial or corporal punishments, not a permanent destination for the accused. Initial constructs for American prisons were heavily influenced by practices in Europe. Often with criminalization, society posits that amenities and conditions of prisons should be inferior to that of the least of the free public; such ideas can be traced to European bridewells and work houses. Work houses facilities for the poor to attain work and better themselves, became a consequence for minor criminal offenses. Conditions of the work houses deteriorated and criminals became synonymous with the condition of the poor. In efforts to reform such conditions, Sir Thomas Beever, an early prison reformist, created the framework for the Gaol, after which early American prisons were modeled. The Gaol, the first instance of the modern prison, meaning it was intended as a destination for criminal offenders, was categorized by the single cell, which he claimed would foster the expectation of reformation. To garner the attention of a wider audience to address prison reform, other philosophers such as Voltaire, Pen and Jeremy Bentham initiated an ideological shift of prisons from places of punishment to institutions of correction. Establishing

a new philosophy of prisons was contemplated by Dr. Benjamin Rush who states three points for the conception of prions as a place: *1. To reform the person who suffered punishment, 2. To prevent the perpetration of crimes. 3. To remove those persons from society who have manifested by their tempers and crimes that they are unfit to live in society.* [1] Dr. Rush also stated that prisoners should have access to gardens for food, exercise, and salable goods to help supplement costs for operating the prison. These points are of utmost relevance in the retooling of contemporary attitudes toward prisons, as these points imply a process rectification as the prime intent of prisons rather than a means to and end for offenders. Hyper alienation, evident in the removed condition of correctional facilities is a counter idea to the advancement of rehabilitation, which is primarily personal but also very much a social exercise.

The ensuing history of the prison which I will begin to unfold is marred with contention between prisoner's well-being and economic profitability of prison institutions, consequentially affecting inmate living conditions. From the mid-19th century to the turn of the 20th century, two camps of prison systems were in use throughout the United States; the Pennsylvania system and the Auburn system. The first system developed, the Pennsylvania system, was characterized by its similarity to English Gaol system, which emphasized extreme isolation of prisoners in single story cell buildings and no work, as to focus primarily on the reflection of the offense to garner penitence. Soon after however, physical and psychological consequences became evident, making offi-

cials quickly add other vocational activities, but more importantly providing the impetus for the development of the Auburn system. The Auburn system looked to improve the condition of the Pennsylvania system by taking Dr. Rush's ideas of a prison compound, ideally a large block building with opposite facing cells, the modern cell block. Both ideological camps upheld core values of silence and penitence, with consequences if silence were unwittingly broken. However, the Auburn system focused on prisoner labor and the conglomerate system, the cell block, which was deemed more efficient than the single story Pennsylvania system. This condition lessened prisoner mental illness due to significant time allowed outside of the cell for prison labor which ultimately benefited the state. Additionally, its construction costs were lower and prisoners in its vocational programs could be used for cheap labor. The economic prowess of such a system soon fell victim to developing prison policy and the logarithmic need of labor in the United States at the onset of the world wars. The lack of social awareness of prisons also took root, as mega block Auburn style prisons were being built in the country side, removed from the population's social perception which produced the criminals, driving a societal stigma of prisons and prisoners which still exist to this day. In addition, the generative intent of silence and penitence, being for rehabilitation, now was employed to keep prison disturbances low and prison factory operations smooth, as to mute the incarcerated from larger social ethos. Furthermore, prison policy began to grow around silence and penitence in order to keep prison populations under control as to maximize their factory production of air crafts and artillery during the onset

of World War I and II. During such a critical period, wardens and their prisons were judged on escapes, disturbances, and production records signaling the another pivotal shift in prison ideology to that of the prison as a place of total control over inmates to maintain a good standing with state officials and to optimize factory output, leaving rehabilitation as a far thought from primary prison policy.

Concurrently, with increased focus on total control in prisons, administrators referenced ideas of Jeremy Bentham, an 18th century English architect, philosopher and idealist. Parliament's request for a prison was the impetus for Bentham's prison design scheme known as the Panopticon, a centrally planned circular building with a central cupola, where guards could look out and see inmates from all directions. [2] The utopic vision of the panopticon was primarily to evoke the immediate acknowledgement of the power structure within which one existed in a prison. Ambiguous habitation of the tower, the all seeing eye, which cast its gaze into every corner of the structure facilitated the subjected reality of prisoners by the fictive relation between inmate and guard in the automatized existence of power in the prisons. [3] Furthermore, giving way to the conditions of the overly securitized control ridden construct of prison surveillance and architecture we have today.

1. The American Prison: from the beginning.... The American Correctional Association, 1983. p. 30

2. The American Prison: from the beginning.... p. 32

3. Foucault, Michel, 1926-1984. Discipline and Punish : The Birth of the Prison. Tran. . Ed. . 2nd Vintage Books ed. New York: Vintage Books, 1995. P. 205

PENNSYLVANIA SYSTEM

The Pennsylvania system was characterized by silence, no socialization, and minimal work for the sake of prisoners mental stability, focusing on solitary confinement as the derivation of penitence

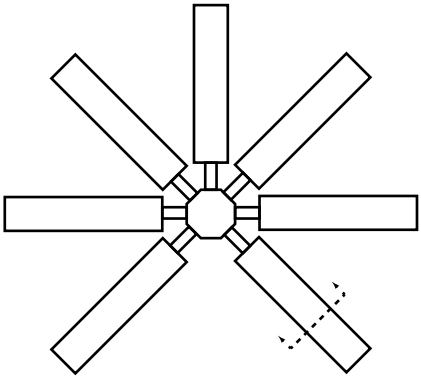
socializing was prohibited

silence was strictly enforced to ensure reflection on ones' offenses

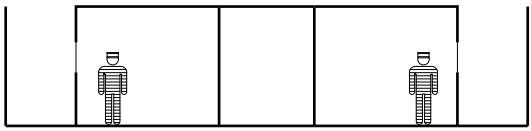
work/crafts were permitted only for inmate's sanity

recreation was minimal

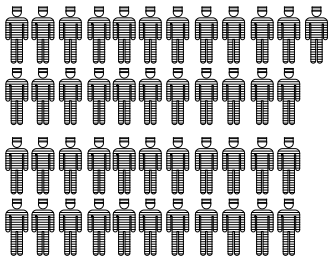
penitence was the core intent of the system



Typical plan of Penn. system prison



Typical section of Penn. system prison, single level



population of Penn. System prisons: 450

AUBURN SYSTEM

The Aubrun system also characterized by silence and penetence offered more economic efficiency than the Pennsylvannia prison system. Aubrun style prisons have large stacked cell blocks, cheaper construction, and vocational training for inmates. This system provided money to the state, and to support the prison, and was ultimately adopted as the primary prison schema in America.

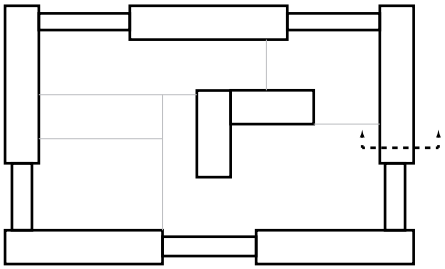
socializing was prohibited

silence was strictly enforced to ensure reflection on ones' offenses

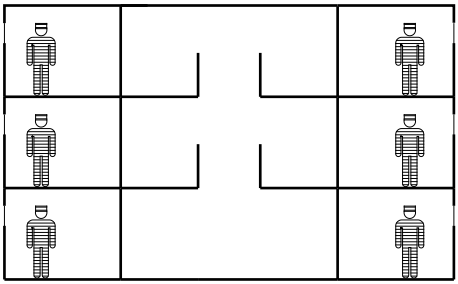
recreation was minimal

work/prodcution was facilitated by vocational programs, for state kickbacks

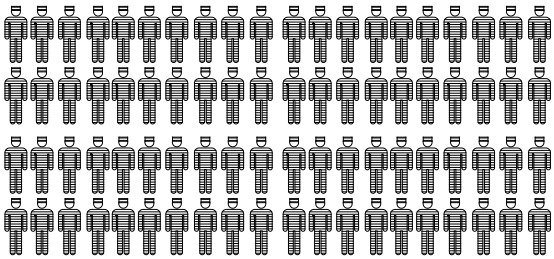
penitence was the core intent of the system



Typical plan of Auburn system prison, with interior yard, where prisoners marched lock step



Typical stacking of Auburn style prisons to house maximum number of inmates, sacrificing cells size



population of Penn. System prisons: 800 +

Prison:
A PENAL PRESENT

"Unknown Inmate"
source: chuckgallagher.wordpress.com

The civilized nations now recognize the fact that legal punishments usually fail of their objects, or cause wrongs and evils greater than those for which the punishments were inflicted; so that penology, or the science of penalties, has still to be created. —*Former President Eliot of Harvard.*

THE LAW AGAINST THEM.

THE IN AND THE OUT

"The In and the Out Penal System 1909"
source: lookandlearn.com

OF OUR PENAL SYSTEM.

THE WORLD AGAINST THEM.

ARCHITECTURE AS PUNISHMENT

The modern-day removal of individuals into the isolated condition of the institution renders them according to Foucault in Discipline and Punish, as individuated bodies, which operate within the politic of the disciplinary constructs of the prison. He goes on to suggest this politic of the body, afforded by disciplinary constructs deemed egalitarian create non-egalitarian power relations in a given context, referencing schools, military barracks, hospitals, and prisons. [1] Foucault's idea of the "disciplinary careers" when the above institutions are aggregated in one's lifespan, each is governed by set of disciplinary protocols of which we are to abide. Those who are noncompliant with the behavior set for by these establishments are considered unfit for residence within their scripted spheres. Consequently, correctional facilities, the aggregation of the noncompliant, today stand by their mission to *"protect society from unruly or dangerous persons who have broken the land and have been senesced to incarceration" and "…protection results from modifying the behavior of the offenders in ways that enable them to return to society as law abiding and productive citizens. Incarceration includes and emphasis on rehabilitation."* [1] Nonetheless, the current state of prison ideology is still ambivalent, with increased spending attempting to deal with skyrocketing prison populations since the 1980's, by building more facilities to house offenders, halfheartedly pursuing means of rehabilitation. Overcrowding is still prevalent throughout the corrections system across the country, with states such as California having built 20 facilities since 1990. With efficiency in mind and the reassurance of the societal tolerance of "out of sight out of mind" mentality toward prisons, the architecture has become

the punishment. Massive concrete walls, minimal fenestration, automatic cell doors and the infusion of closed-circuit television dehumanize correctional facilities minimizing guard to prisoner contact which accelerates isolationism among inmates. These conditions characterize the majority of facilities in the U.S., leading to high rates of recidivism, a re-offense of a released criminal, feeding a vicious cycle of social and identity crisis of individuals who are victims of the machine of corrections. Facets of rehabilitation such as pharmacies and psychological services fail to function under the overcrowded conditions, leaving many inmates untreated, yielding high risk individuals with exposure to the general population of the prison, and to the public if released. In addition, the "three strikes" law adopted in the majority of states, and the increasing privatization of prisons has resulted in longer-term prison sentencing and minimum sentencing requirements for criminal infractions, respectively. The majority of the stifling 50 billion plus spent by the correctional department each year is to keep prisoners, roughly $30,000 a year, in the defunct facilities, far outweighing spending on vocational and socialization efforts. Two quotes, one by a Conservative British home secretary and one by Michael Jacobson, former commissioner of the New York City Department of Correction effectively characterize the current state of prison design and role in inmate betterment.

"an expensive way of making bad people worse."
- Conservative British home secretary

"It's absurd to think that the worse you make these places, the less recidivism you'll have,"

- Michael Jacobson

The point of diminishing returns is evident in the system of priorities adhered to by the Department of Corrections. However, design can be a fundamental tool in the reimagining of the prison culture and our responsibility as architects of encouraging socially accountable prisons with the intent of every man or women ultimately being reintegrated into the general public.

There are trends which the United States can begin to reference from other countries in their efforts to hearken back to the generative concept of the reformatory intent of prisons, dispelling the stigma of architecture as punishment which has become so clear today. Prisons such as Leoben in Austria and Halden in Norway are spearheading efforts for the prioritization of critical design strategies in combating the dogma that surrounds correctional institutions. Forgoing the rigid criteria of bed counts and space requirements imposed on many architects who endeavor to design prisons, these institutions focus on the dignity of every human being. The assistant Warden noting that, though Loeben houses criminals, they are still human beings, and their philosophy was maximum security on the outside, a sturdy perimeter wall to the prison compound, and a maximum freedom interior, noting normative amenities in cells which one usually would find in an apartment, in addition to light filled space.

Though currently being pursued abroad, design as a rehabilitative mechanism for corrections has not been a priority of social responsibility taken on by the United States Department of corrections; a linkage of social awareness must be made to bring conviction to policy and design which prioritizes the convalescence of offenders.

1. Foucault, Michel, 1926-1984. Discipline and Punish : The Birth of the Prison. Tran. . Ed. . 2nd Vintage Books ed. New York: Vintage Books, 1995. P. 299

2. Kliment, Stephen. Building Type Basics for Justice Facilites. Hoboken: John Wiley & Sons., Inc, 2003. p. 117

San Quentin State Prison, Ca
source: foundsf.org

Leoben Prsion, Austria
source: anecdotoff.com

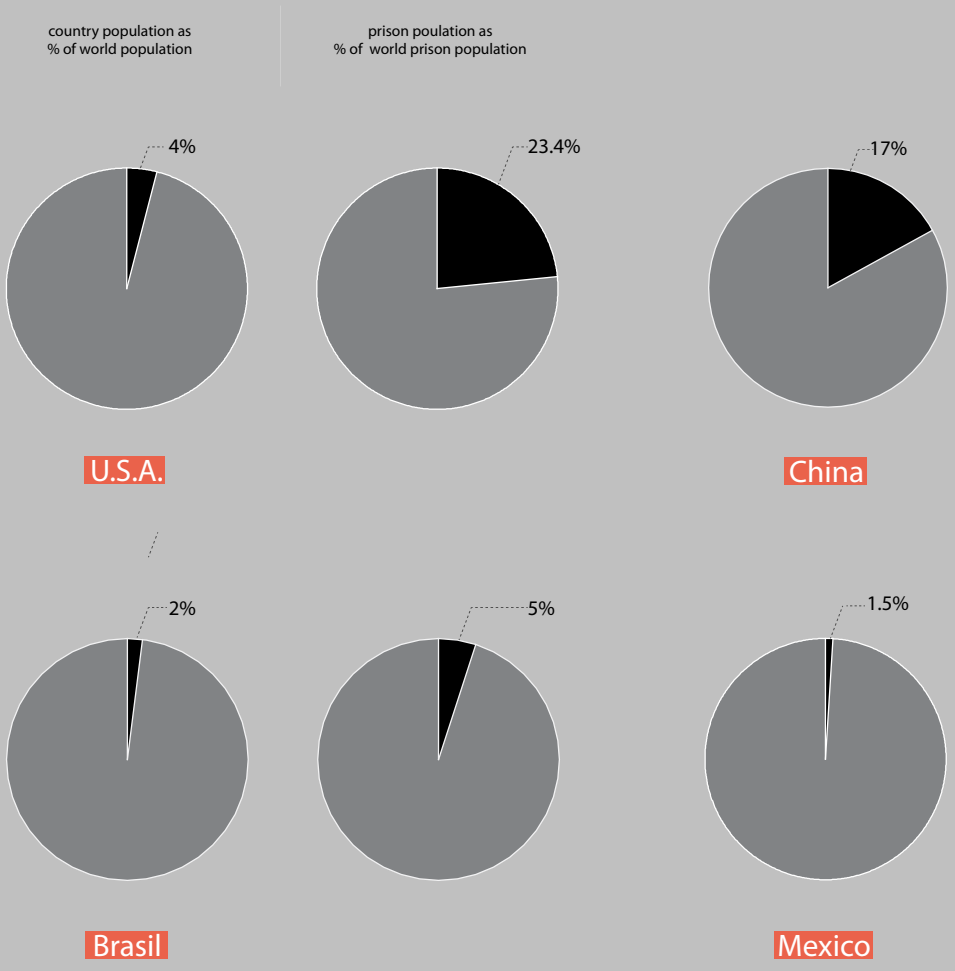
Sing Sing Prison, NY
source: plainkate.com

Haledn Prsion, Norway
source: archdaily.com

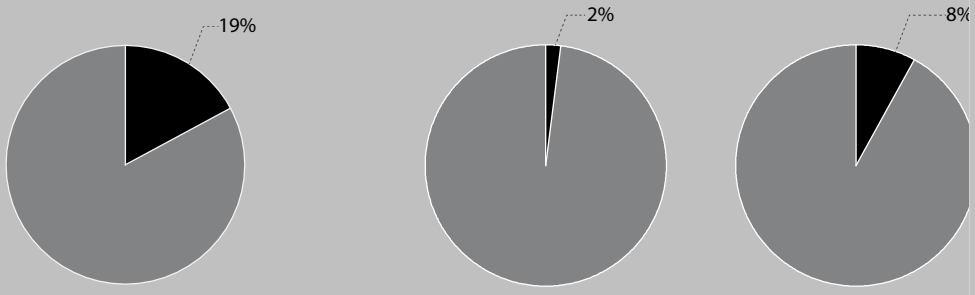
Central Prison, NC
source: doc.state.nc.us.com

Leoben Prsion, Austria
source: anecdotoff.com

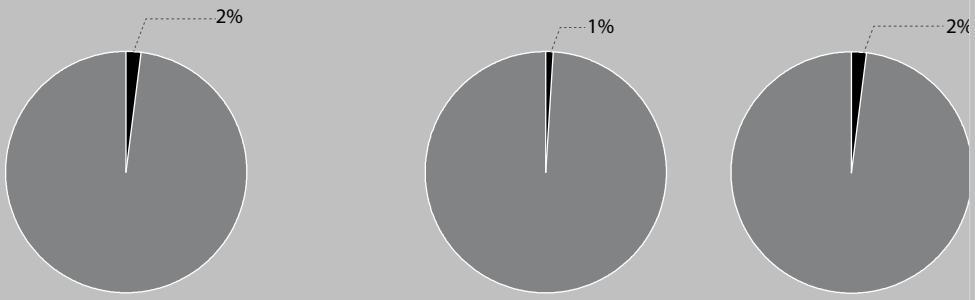
The disproportionate ratio of the imprisoned to free population in the U.S. requires a critical examination of facilities, policies, and reclamation processes in use in correctional facilities. Below are comparisons between countries according to their population as a percentage of the global populous, and their prison population as a percentage of the global prison populous. Note, it is a wise assumption to infer that a country's prison population would be proportional to its total population's percentage



of the world, and sure this is evidenced in the majority of the countries below. However, the United States, which boasts one quarter of the world prison population, has a prison populous ratio that is 600% higher than its total populous ratio.

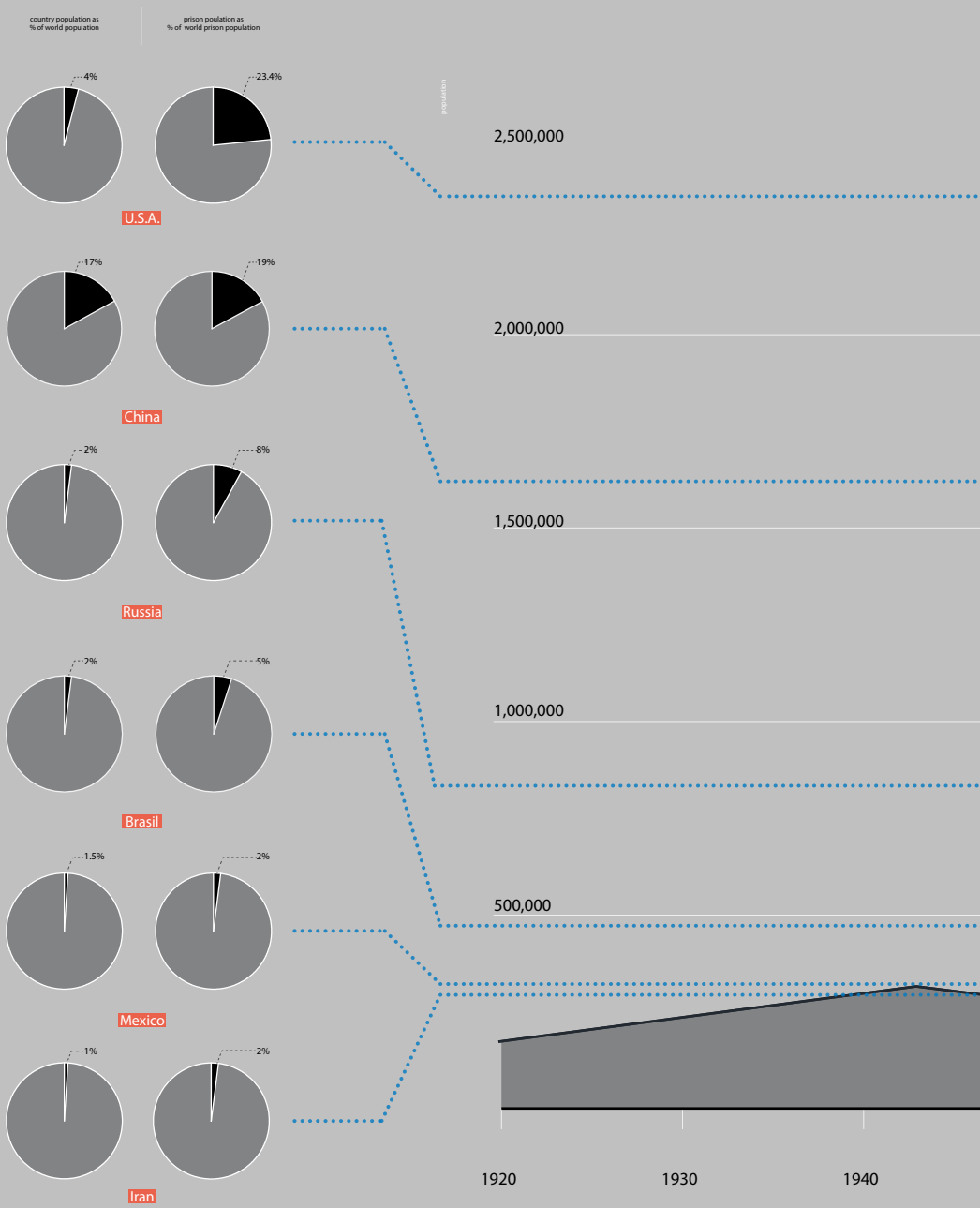


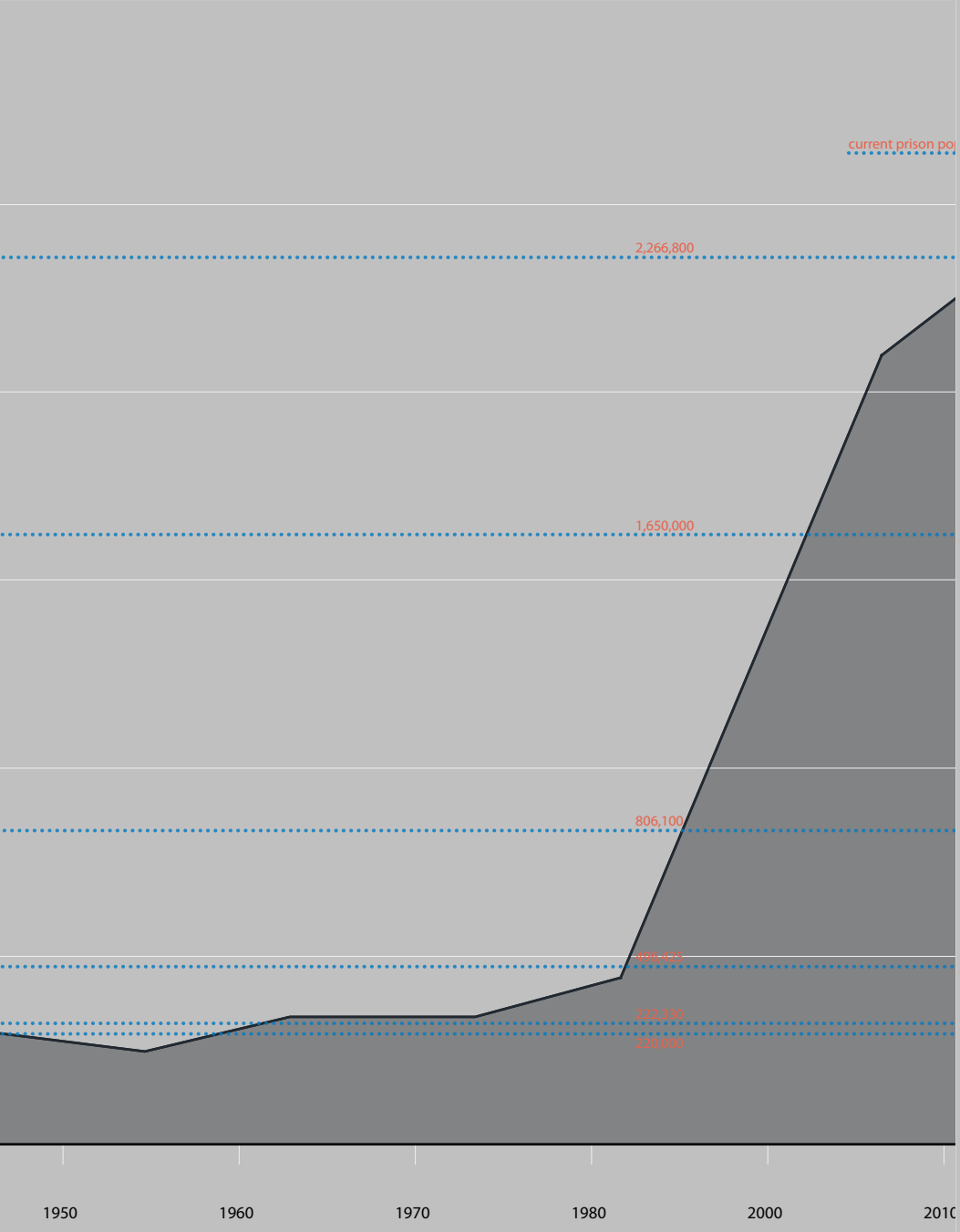
Russia



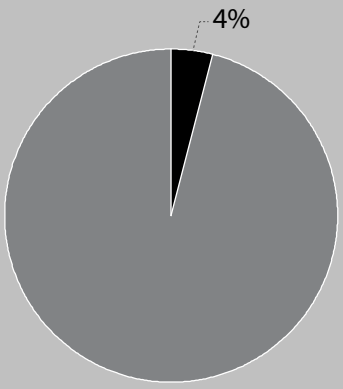
Iran

source: news.bbc.co.uk

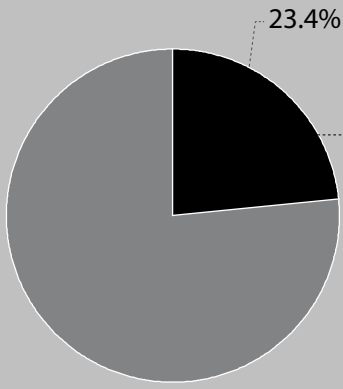

country population as % of world population
prison poulation as % of world prison population
4%
23.4%
U.S.A.
17%
19%
China
2%
8%
Russia
2%
5%
Brasil
1.5%
2%
Mexico
1%
2%
Iran
population
2,500,000
2,000,000
1,500,000
1,000,000
500,000
1920
1930
1940



source: news.bbc.co.uk

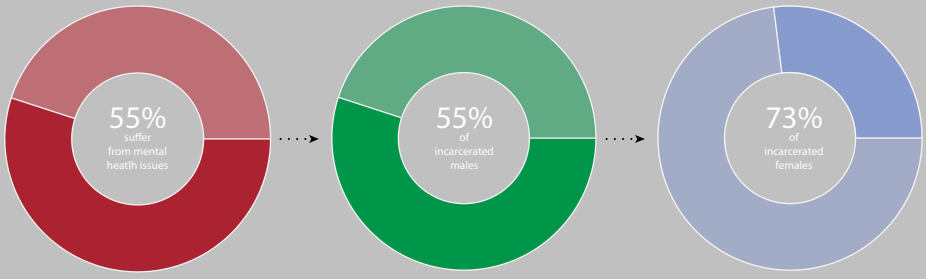


% of world population



% of world prison population

U.S.A. POPULATION 314,064,527
INCARCERATED POPULATION 2,266,800



top 5 behavioral symptoms of inmate mental health problems

49.4 %

Persistant anger and irritability

49.2 %

Insomnia or hypresomnia

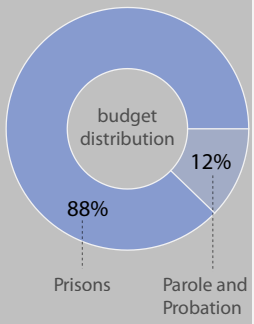
4

psyc
agit
reta

CORRECTIONS IS THE SECOND LARGEST STATE EXPENDITURE BEHIND MEDICAI

$ 74 BILLION

US ANNUAL CORRECTIONS SPENDING

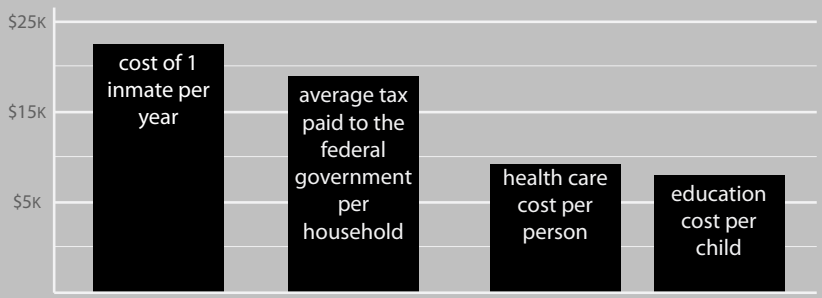


$ 78.95 PER DAY + 66% for elderly population

OR

$ 18K - 31K

US AVERAGE COST TO KEEP A PERSON IN PRISON



46.2 %

thomotor
tation or
ardation

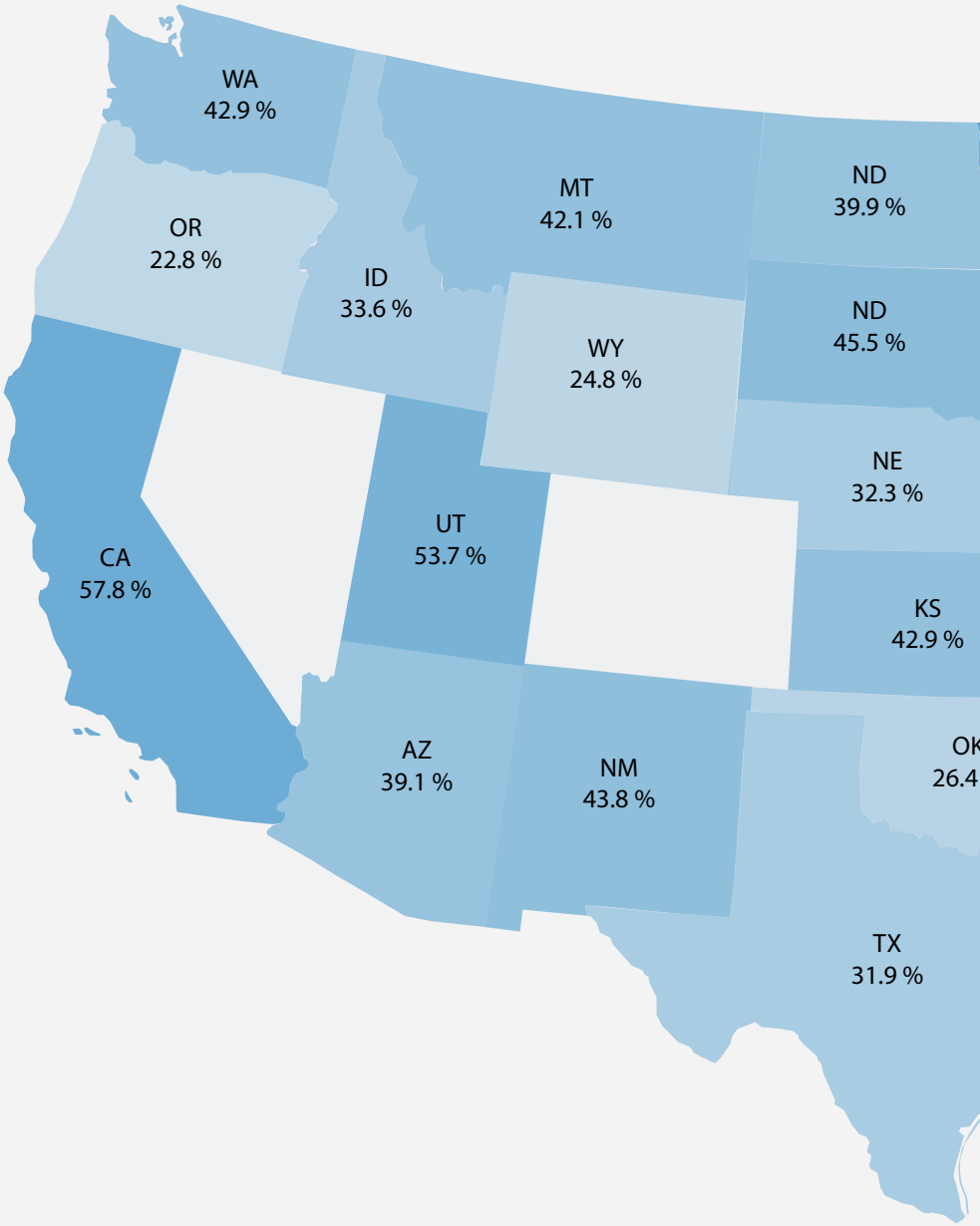
43.0 %

feelings of worthlessness or excessive guilt

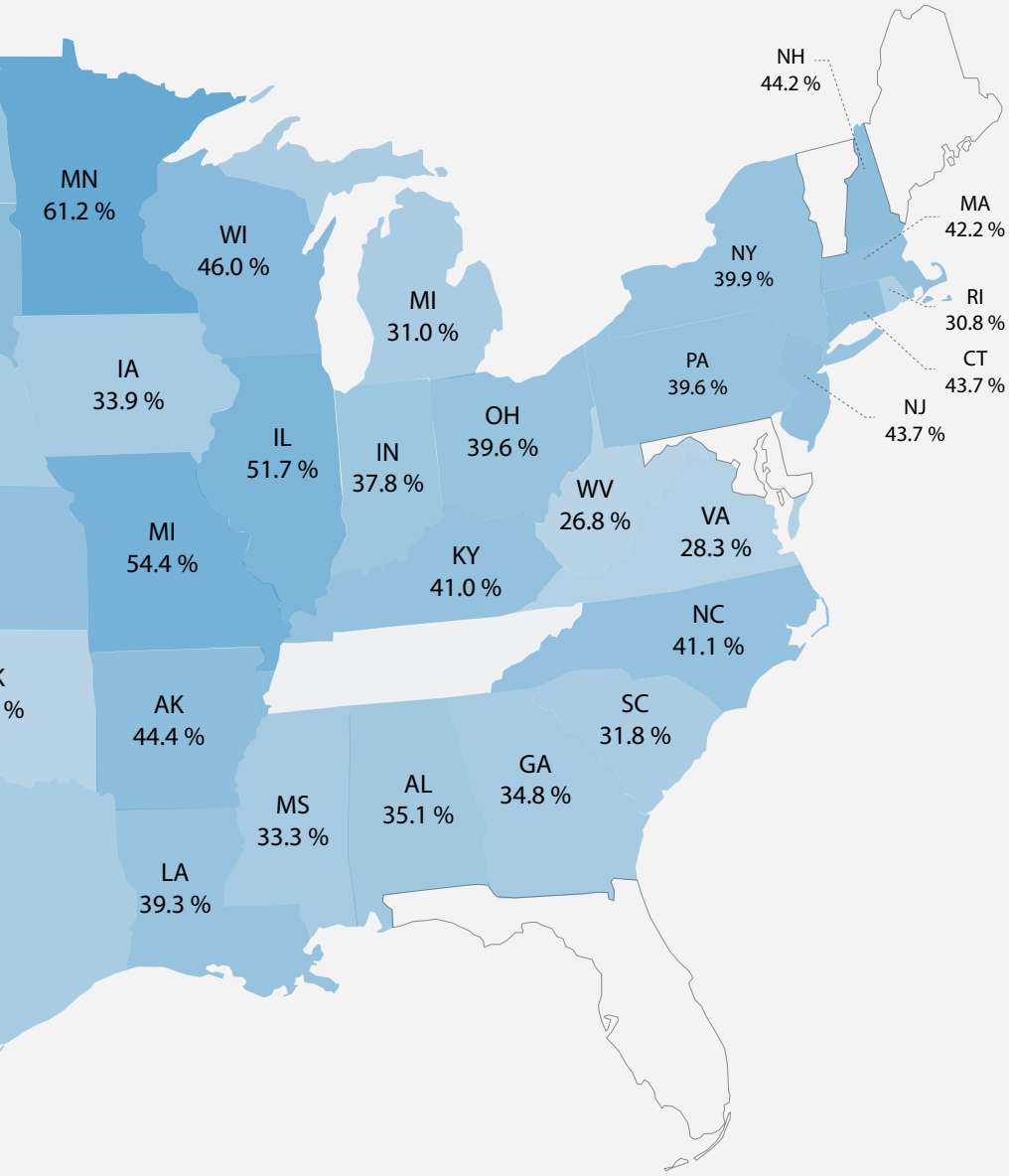
42.8 %

increased or decreased appetite

source: corrections.com



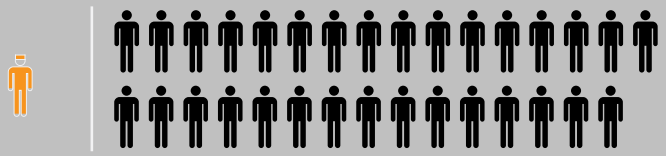
NATIONAL AVERAGE
RECIDIVISM RATE : 43.3 %



source: i.usatoday.net

ACCORDING TO THE U.S. BUREAU OF JUSTICE STATISTICS, MORE THAN **7.3 MILLION** PEOPLE ARE ON PROBABTION, IN JAIL, OR ON PAROLE.

3.2 % of ADULT POPULATION



1 of 31

1 IN 18 ADULT MEN ARE BEHIND BARS OR IN UNDER CORRECTIONAL SUPERVISION

3.2 % of ADULT MALE POPULATION

1 of 18

RATIO OF INCARCERATED TO CIVILIAN POPULATION

(PER 100,00 PEOPLE)

HIGHEST

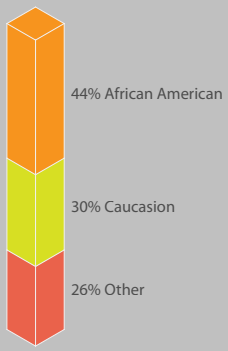
816 per 100,000

LOWEST

148 per 100,000

AFRICAN AMERICANS ACCOUNT FOR **12%** OF THE U.S. POULATION, BUT COMPRISE **44%** OF THE PRISON POPULATION

U.S. Prison Population



U.S. Prison Population

NATIONAL SPENDING ON PRISONS VS. HIGHER EDUCATION (1987-2007)

+ 21%
HIGHER EDUCATION SPENDING

+ 127%
CORRECTIONS SPENDING

PRISON POPULATION V. HIGHER ED. POPULATION

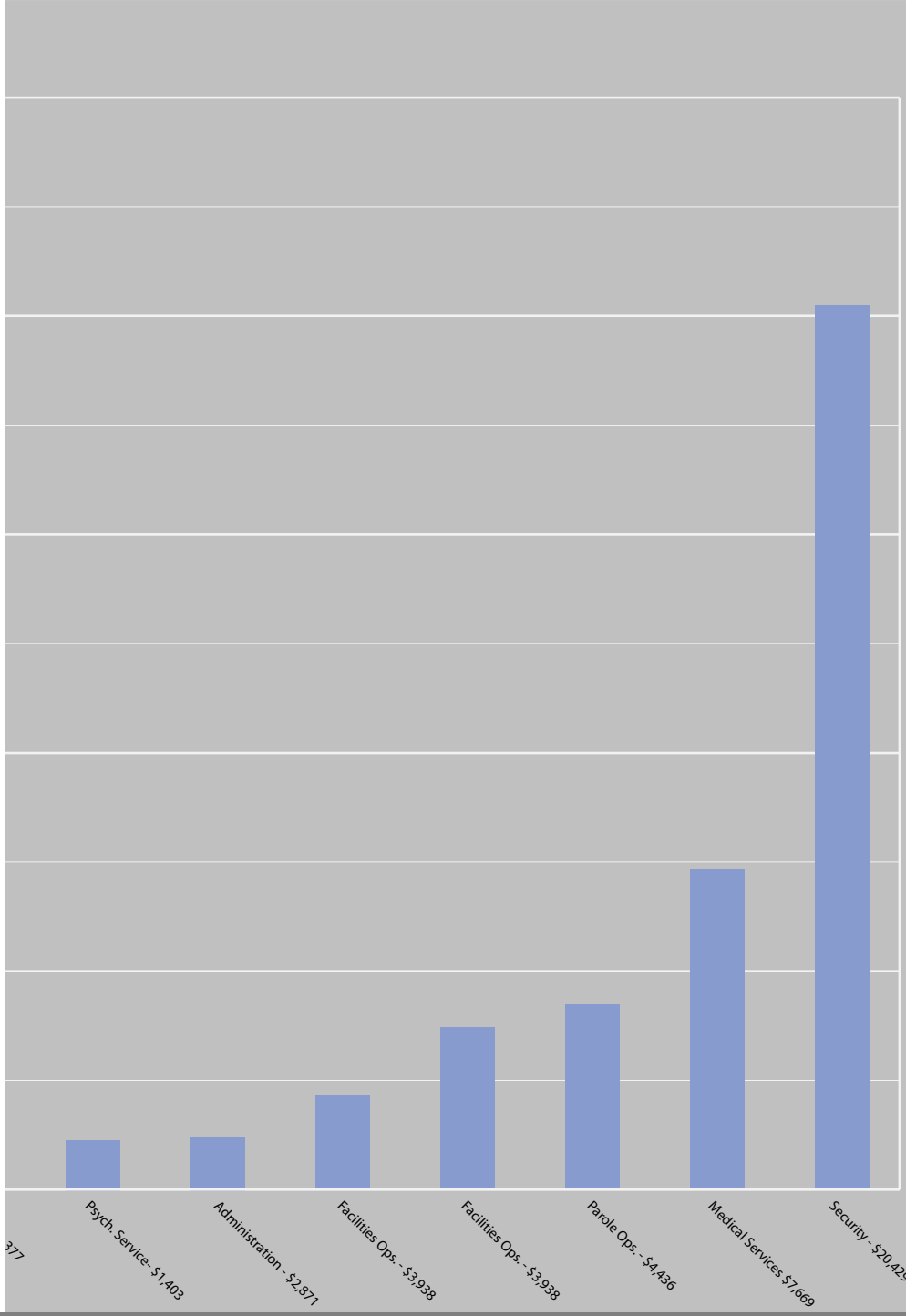
16 MILLION
COLLEGE STUDENTS

2.3 MILLION
PRISONERS

source: bureau of justice statistics

A major component of rising incarceration rates is the exploitation of prison labor for the benefit of private prisons and industry, termed the **prison-industrial complex (PIC)**. Enforcement of policies such as "three strikes" in addition to continued expansion of prison construction, are initiatives upheld by prison guard unions and the privatized correctional sector to fuel and maintain imprisonment rates. Companies which have outsourced production to foreign nations are being lured back to the Americas with the promise of cheap labor via prison factories; such is the case of Nike factories in Indonesia being coaxed back to Oregon prisons. There are 37 states that have passed legislation legalizing the contracting of prison labor to privatized companies. This has generated a micro-economy including many of the most prolific U.S. companies, such as AT&T, IBM and Dell to name a few, are fueling investments with the promise of cheap prison labor. This epidemic has led to the upholding of minimum sentencing policies and longer sentences assisting the high incarceration and retention rate of U.S. prisons.

Prison Industrial Complex Example: California Department of Corrections Spending



Breakdown of the $49,000 spent on California prisoner per year. Most, 65% is spent on staffing and personnel cost, rather than inmate care and initiatives.
source: adpsr.org

PROGRAM

Projecting future scenarios of the relationship between the prison and the prisoner beyond security and control offer opportunistic designs to mental and behavioral states as a premise for design investigation. Dated dimensional, material and social criteria must be reconsidered in light of new research concerning neural and behavioral mechanism which are helping scientists and designers understand the way the environment influence our mental structures. Correctional facility planners and Justice Facility architects will benefit from such research because the environments they implement are paramount to the resultant behavior of inmates, a top priority in the design considerations of correctional facilities. New primacies of enriched environments and a societal prison conscious are posed here as tools to reassess the current design and social state of prisons.

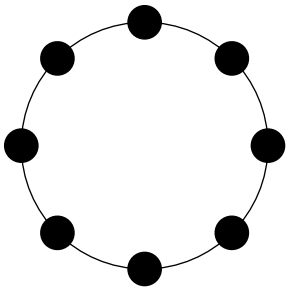
An enriched environment, spatial constructs which are embedded with deliberate neural cues, transforms the familiar state of the physical into an operative mechanism formulating associations and behaviors. For example, prison yards are spaces for the masses, large small old and young, to congregate, leading to breading conditions for anxieties and phobias. Discretizing such a collective into smaller socially compatible spaces can encourage balanced reception in serotonin 5-HT1 and 5-HT2 receptors, alleviating anxieties due to perceive equality among the smaller populous. Employing novel condition in the culture of prison design offered by new literature on neural and behavioral sciences allow new frameworks for rehabilitative possibilities.

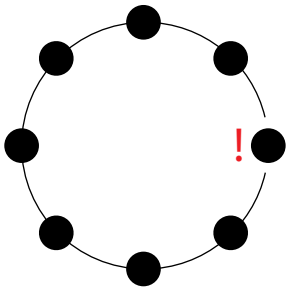
Reasserting the incarcerated in the conscious of the public is an equally important imperative as the design of the facilities themselves. Insular operations of prisons have rendered them devoid of the external economic, social, and power structures. Therefore, social aptitude in addition to poor rehabilitative methods of current prison systems release unfit individuals back into society leading to homelessness, unemployment, and high rates of re-offense. The 7 out of 10 male prisoners reoffend within the first three years of being released. Allowing businesses and community operation to work tangentially with prisoners on the track for release can assist correctional departments in the socialization of newly freed individuals.

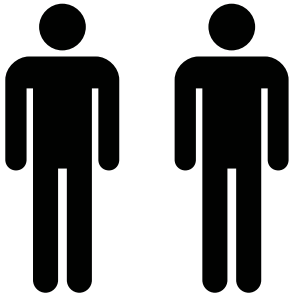
These two ideas embrace the premise that prison is not a destination for those who commit offenses in society, but is a process of reconditioning individuals' mental and behavioral states for reinstatement into constructs of civil liberty.

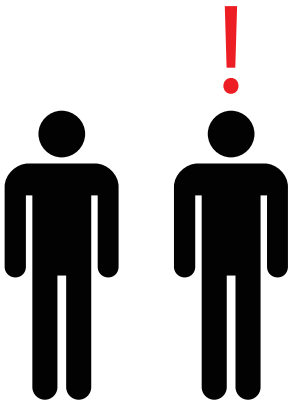
Now, the consolidation of divergent opinions needs, and ambitions in the freeze-frame that a new architecture inevitably represents can only be realized at the expense of internal contradiction. Prisons have been built where the building offers a degree of enlightenment beyond that of the regime, or where the regime attempts to invalidate the modernity of the building. If prison architecture today can no longer pretend to embody an »ideal«, it could regain credibility by introducing the theme of revision as raison d' être.

- Rem Koolhaas



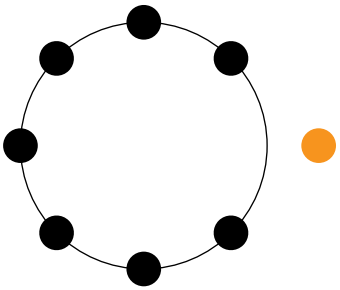


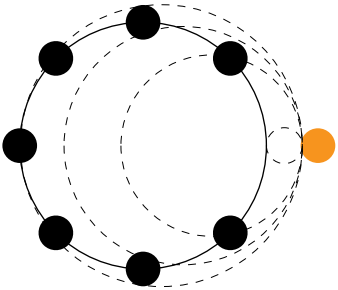


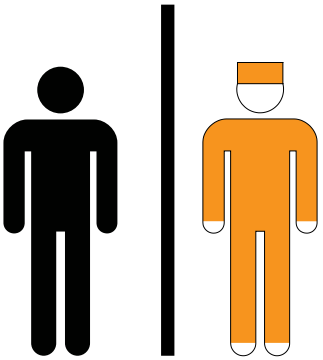


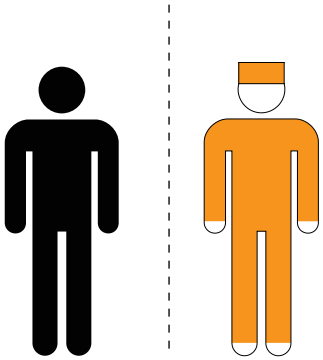
society

criminal offense



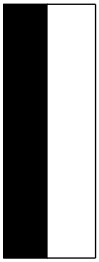






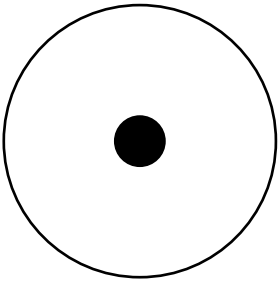
prison isolation:
current system

reintegration into social conscious:
proposed system



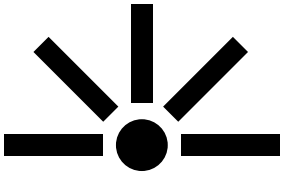
17th century

early quaker prison



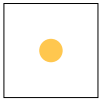
1791

panopticon

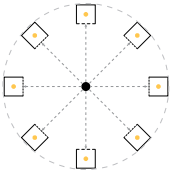


1829

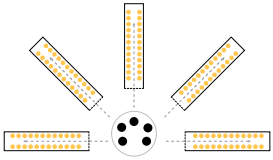
radial model



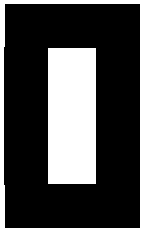
isolation



maximum visibility

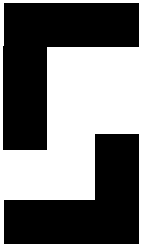


visibility and capacity



1847

conglomerate model

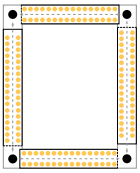


1990

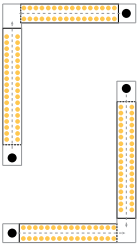
courtyard

20xx

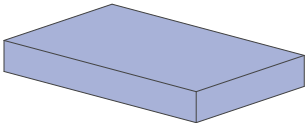
?



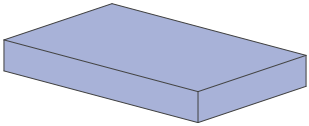
maximum capacity ,
minimal guards



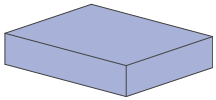
guard cell block
assignment



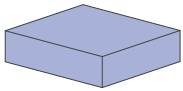
Outdoor Recreation
(5300 sq.ft.)



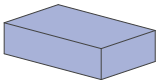
Indoor Recreation
(4000 sq.ft.)



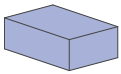
Dining
(2000 sq.ft.)



80 - Showers
(1440 sq.ft.)

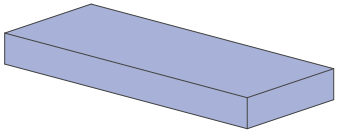


Library
(1000 sq.ft.)

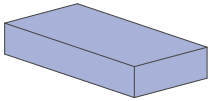


Dayroom
(720 sq.ft.)

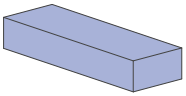
INMATE PROGRAM



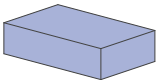
Kitchen
(4000 sq.ft.)



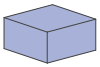
Industrial
(4000 sq.ft.)



Vocational
multiple - (1200 sq.ft.)

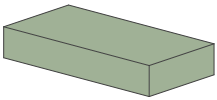


Chapel
(1000 sq.ft.)

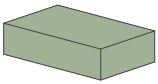


Laundry
(100 sq.ft.)

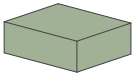
Cell
(300 - 108 sq.ft.)



Intake
(1800 sq.ft.)



Infrimary
(1000 sq.ft.)



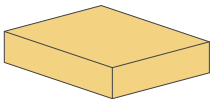
2 - Classroom
(750 sq.ft.)

Secondary Control
(120 sq.ft.)

Secretary
(120 sq.ft.)

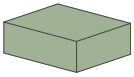
Misc Office
multiple - (100 sq.ft.)

STAFF PROGRAM



Visting Center
(2000 sq.ft.)

PUBLIC PROGRAM



2 - Classroom
(750 sq.ft.)

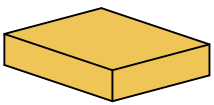
Counsel Room
multiple - (300 sq.ft.)

Mass Control
(120 sq.ft.)

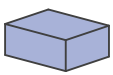
Counselor Office
multiple - (100 sq.ft.)

Caseworker Office
multiple - (100 sq.ft.)

Correctional Officer Post
multiple - (20 sq.ft.)



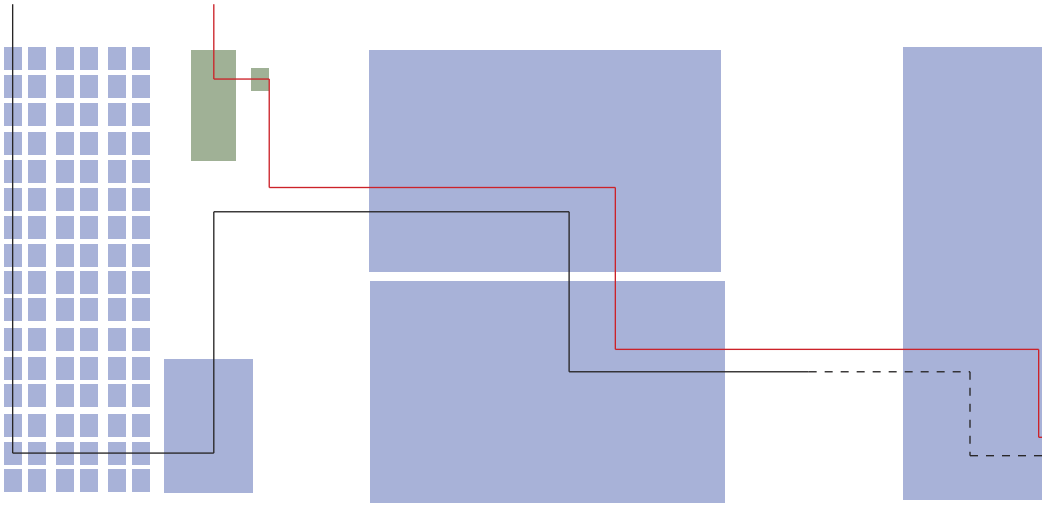
Auditorium
(2000 sq.ft.)



Misc Recreation
(multiple) - 1800 sq.ft.)

Product Kiosks
(multiple - 1800 sq.ft.)

NEW PROGRAM



Cell Block Program

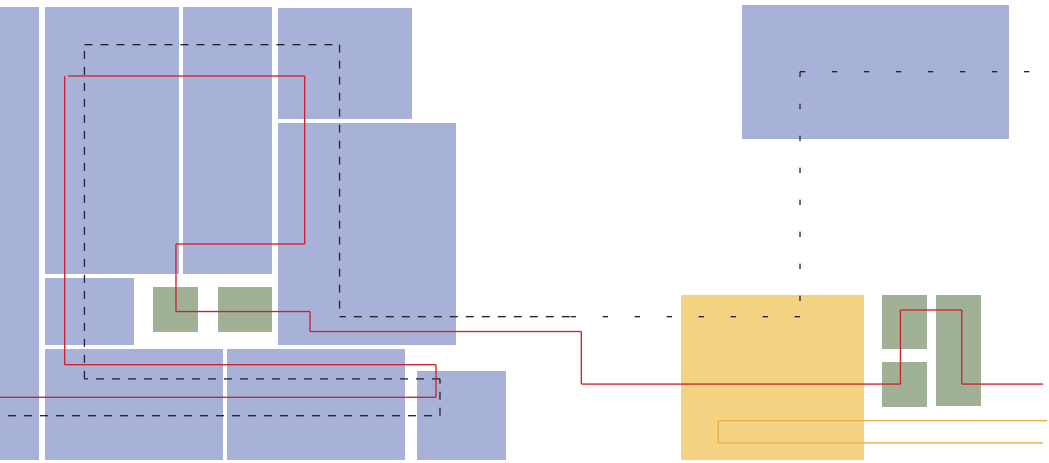
Cells
Dayrooms
Secondary Control
CO post(s)

Reacreation Program

Outdoor recreation
Indoor recreation

staff program
inmate program
visitor/public program

staff access
public access
inmate access
inmate facilitated access
inmate highly facilitated access

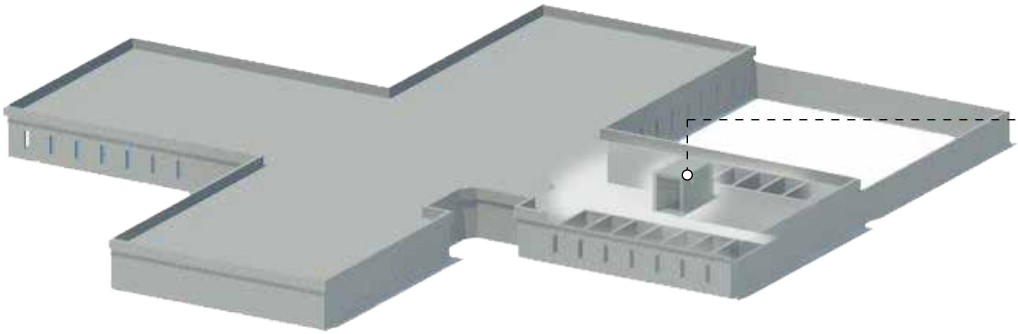


Facilitated Program

Chapel
Library
Case worker office
Counselor
Laundry
Dining
Counselor room(s)
Vocational
Infirmary
Classroom
Kitchen

Administrative/Public Program

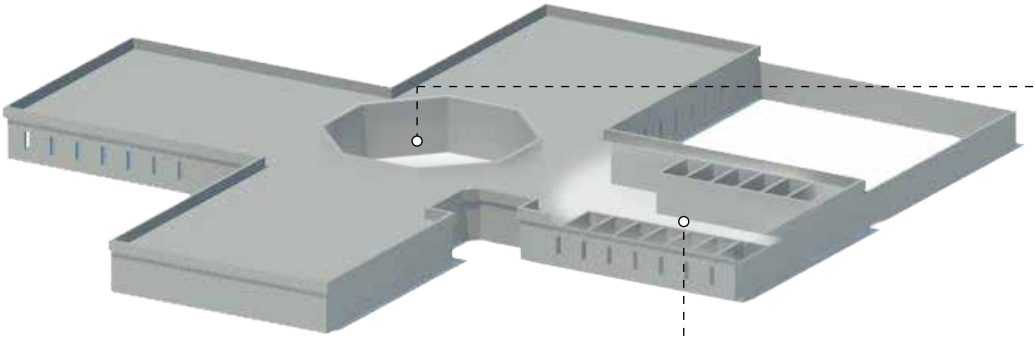
Visitation
Intake
Office(s)



stressors	ramifications
crowding	stress/anxiety
small sq. ft.	anxiety
limited/irregular light	erratic sleep patterns
material hardness	increased noise
material color	least stimulating color
material tactility *polished concrete*	low somatosensory stimulation

The Cell- prison cells are the primary spaces of incarcerated individuals, and provide sleeping quarters, bathroom facilities, and spaces of personal reflection. However, they are often built of concrete and filled to maximum capacity, along with increased noise levels this creates disturbing environments for housed individuals.

resulting neurological processes	resulting behavior
decrease in proportion of 5-HT_1 to serotonin to 5-HT_2 increase in dynorphin production	decreased sociability depression behavior
decrease in proportion of 5-HT_1 to serotonin to 5-HT_2 increase in dynorphin production	decreased sociability learned helplessness
imbalance in meltonin and cortisol production	erratic circaidan ryhtms increased stress
deficiecy in serotonin 5-HT_1 receptors	decreased sociability increased stress
lower levels of acetylcholine and glutmate production	decreased synaptic plasticity decrease in goal oriented behavior
lower levels of acetylcholine production	decreased synaptic plasticity decreased memory formation decreased sensory sensitivity



social perception

stress/anxiety

limited access
/ smell of food

*(dopomine release
increased appetite)*

hunger during
increased appetite

Intake- usually centrally located, intake areas are high stress spaces for inmates and also provide the first opportunities of interaction between correctional officers and new inmates. Abrupt transitions from the outside into the insular intake area along with unfamiliar socialization of inmate groups can disrupt neurological patterns

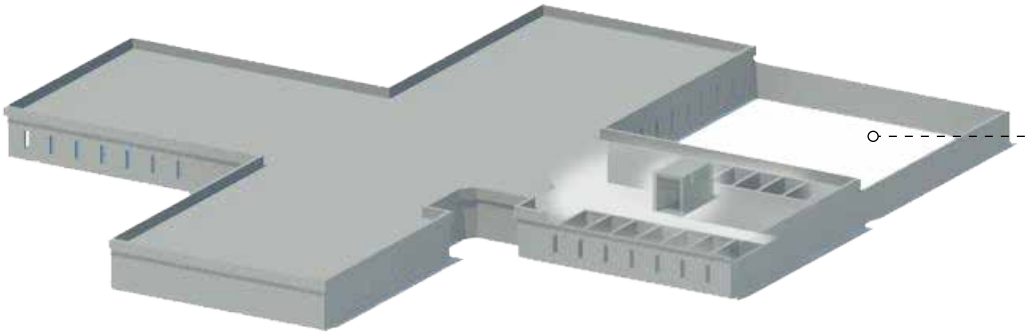
decrease in proportion of 5-HT_1 serotonin to 5-HT_2
increase in dynorphin production
decreased dopomine production

decreased sociability
depression behavior
decrease in cognition

Dayroom- The informal space usually located between cell spaces allows for the limited social interaction afforded to prisoners. In lower security facilities, this can also be doubled as the dining space. Because dayrooms are used for leisure, no tasks or goals are associated with the space resulting in ulterior social gatherings which promote lascivious and deceptive behavior, raising tension among inmates.

increase in dynorphin production
decreased dopomine production
decreased serotonin production

decreased sociability
learned helplessness
appetite loss
decreased cognition



social perception

stress/anxiety

recreation

not goal oriented

The Yard- Similar to the day room, offers inmates exterior space for recreation as set parts of the day. The yard is used primarily for exercise and socializing. However, no tasks or goals are associated with the space, resulting in ulterior social gatherings which promote lascivious and deceptive behavior, raising tension among inmates.

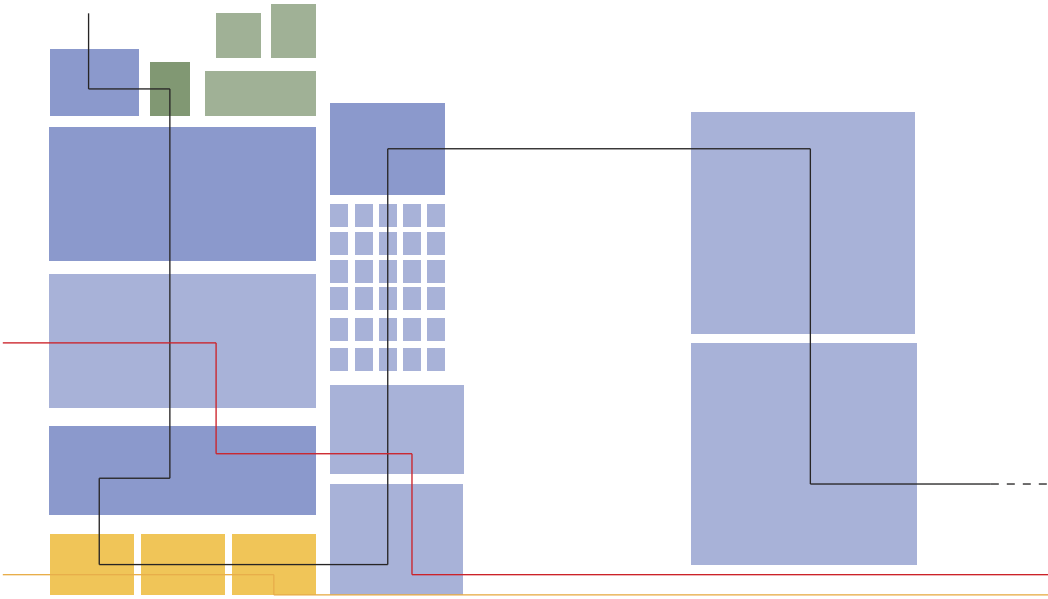
decrease in proportion of 5-HT_1 serotonin to 5-HT_2
increase in dynorphin production
decreased dopomine production

decreased sociability
depression behavior
decrease in cognition

minimal acetylcholine and dopamine production

decrease in goal creation
decrease in synaptic plasticity

In addition to the major programmatic spaces listed above, many facilities often have spaces for education, religion, and visitation as supplementary opportunities for incarcerated individuals.

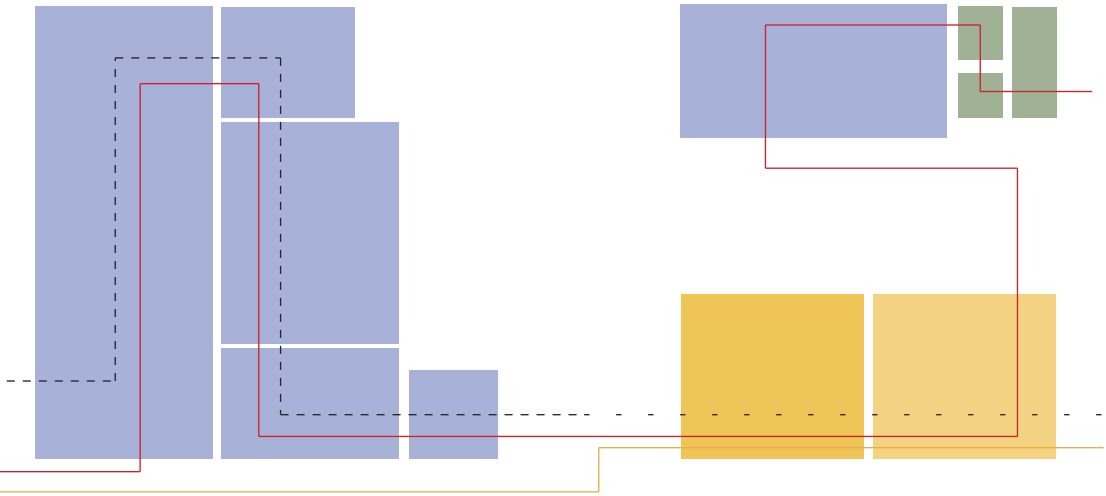


Cell Block Program

Cells
Dayrooms
Secondary Control
CO post(s)
Library
Case worker office
Counselor room(s)
Vocational
Counselor
Classroom
Misc recreation
Garden

Reacreation Program

Outdoor recreation
Indoor recreation



Facilitated Program

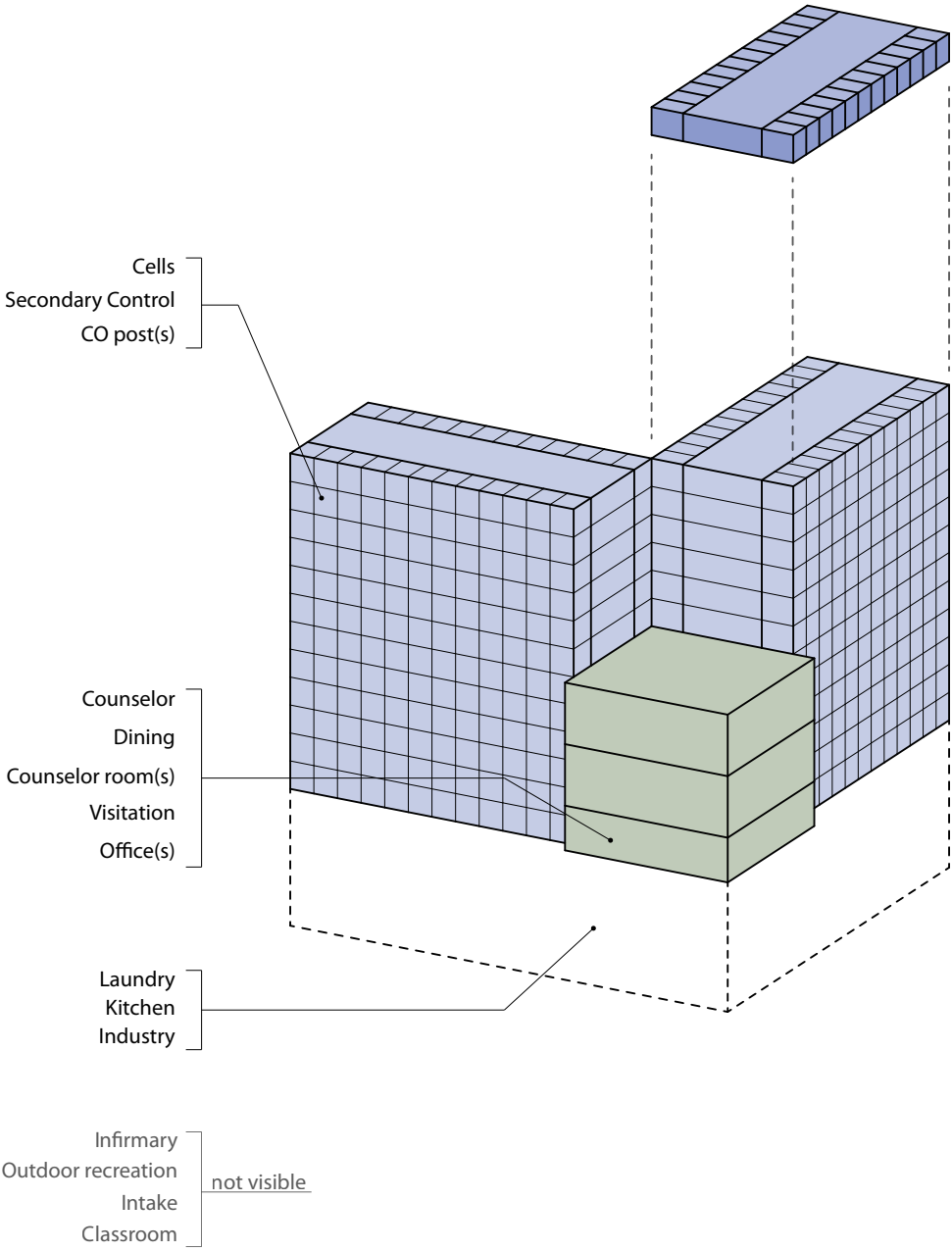
Chapel
Laundry
Dining
Infirmary
Kitchen

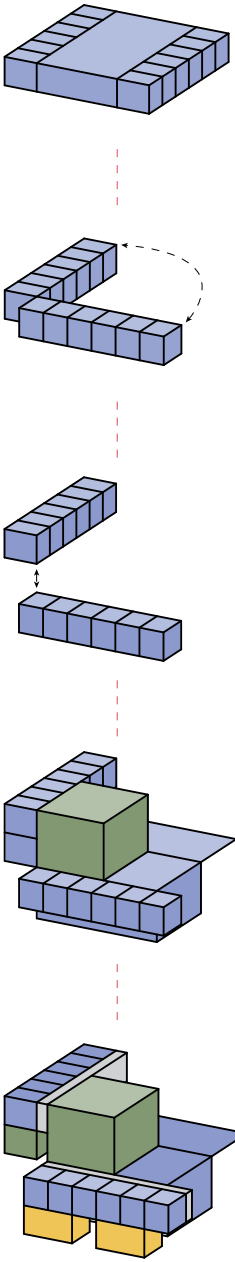
Administrative/Public Program

Auditorium
Visitation
Intake
Office(s)

staff program
inmate program
visitor/public program

staff access
public access
inmate access
inmate facilitated access
inmate highly facilitated access


Cells
Secondary Control
CO post(s)
Counselor
Dining
Counselor room(s)
Visitation
Office(s)
Laundry
Kitchen
Industry
Infirmary
Outdoor recreation
Intake
Classroom
not visible



typical cell block module

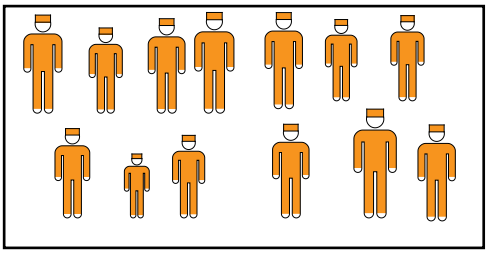
split cell block for light and
new program adjacency

vertical cell shift

nest facilitated programs within
new cell block composition

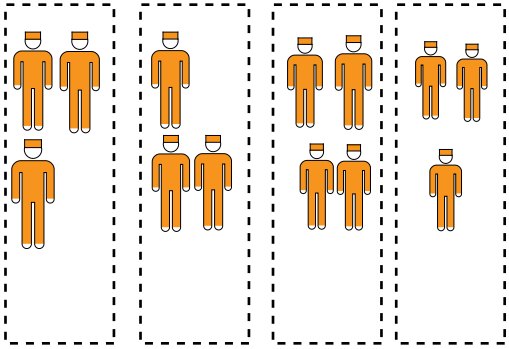
potential public programadjacent
to localized industry/vocational
programs

present



non differentiated intake and yard conditions

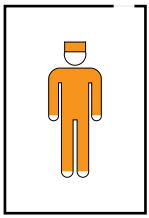
proposed



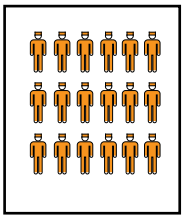
differentiated intake and yard condition

benefits of filtered intake and discritized yard conditions according to characteristics such as age, weight, and height can increase inmate self -perception and anxiety levels

BOUNDARY CONDITIONS

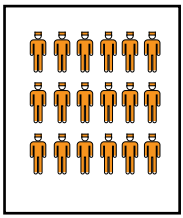


cell



classroom

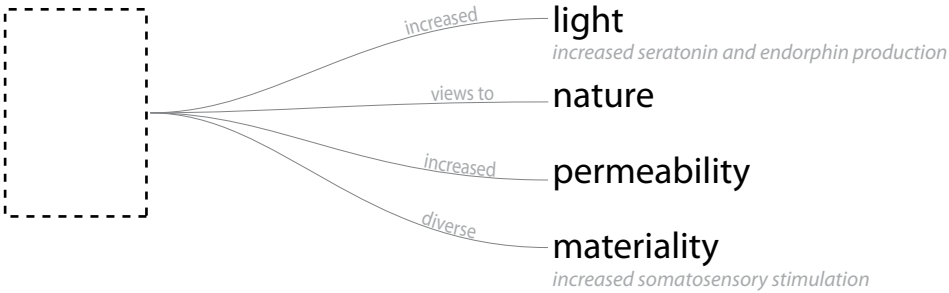
usally entirely interior rooms



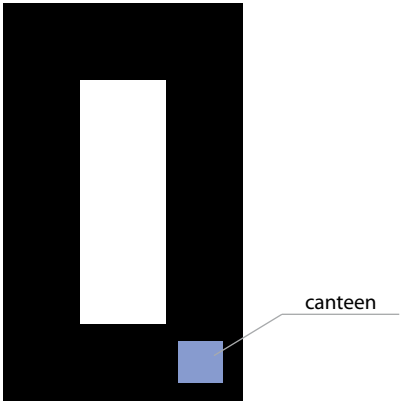
infirmary

has limited permeability

BOUNDARY CONDITION CONSIDERATIONS

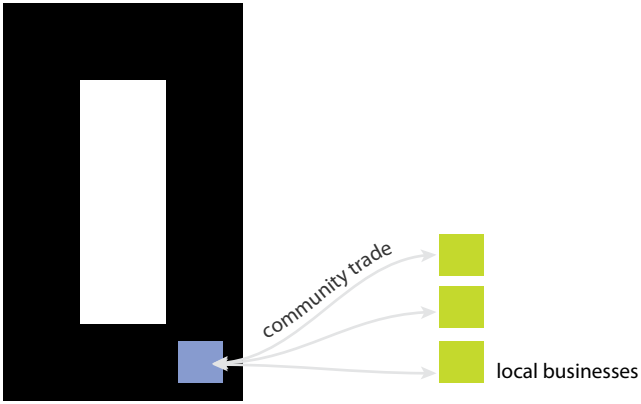


present



canteen is limited to prison operations

proposed



canteen's linked with external buisness exposes inmates to exterior power structures and economies

APPENDIX

Mission

The mission of the Academy of Neuroscience for Architecture is to promote and advance knowledge that links neuroscience research to a growing understanding of human responses to the built environment.

The Academy benefits from the expanding body of research that has evolved within the neuroscience community in the last two decades, and the promise of even more in the coming century. Some observers have characterized what is happening in neuroscience as the most exciting frontier of human knowledge since the Renaissance. All humanity stands to benefit from this research in countless ways still to be determined. The profession of architecture has become a partner in developing the application of this knowledge base in order to increase its ability to be of service to society.

Key People

John P. Eberhard, FAIA, is founding president of the Academy of Neuroscience for Architecture and currently its executive vice president. He is a fellow of the American Institute of Architects, Latrobe Fellow of the AIA College of Fellows in Washington, DC, and visiting scholar in the division of biology at the University of California at San Diego. He has forged a fruitful collaboration between the fields of neuroscience and architecture, helping to build a body of literature for architects which helps decode the affects of designed environments

Fred H. Gage Ph.D is a professor in the Laboratory of Gnetics at the Salk Institute in La Jolla, Ca. Gage in conjunction with neuroscientist Peter Eriksson discovered neurogenesis, the process by which the brain creates new neurons, demonstrating the ability of the adult brain to create new neurons, which was previously thought not to be possible.

This discovery shifted scientists views of how the brain behaves, suggesting the brain had the ability to repair itself after traumatic injury. Gage is currently pursuing research which attempts to understand how the new brain cells are created. Gage has proven that physical exercise and environmental enrichment can enhance the manner in which new nerve cells grow.

Premise

Research has demonstrated that correctional environments can have positive or negative impacts on inmate behavior, contributing to or inhibiting the achievement of facility operators' objectives – such as safety, security, order, freedom from assaults and destruction of property. These can be influenced by environmental factors such as crowding, space allocations, availability of resources, noise levels, natural light, and other factors.

Topics of Inquiry

Light considerations in correctional facilities given by Julian Thayer, research partner.

- There is research about sleep deprivation and its impact on gluco-steroids and glutamates which regulate the metabolism of sugars

- Light (and noise) in correctional settings might have a major impact on sleep deprivation and that, in turn, might have many behavioral outcomes

- Light, especially sunlight, regulates our biological clocks.

Topics of Inquiry: (cont'd)

Color considerations in correctional facilities

- The color wheel can be related to an "emotional scale or wheel". Julian refers to Sokoloff's basic research. Factors include valance (positive or negative), arousal, aggressive/submissive.

- Among the factors in operation are a need for stimulation – variation and complexity are good, sometheing to look at, especially something that changes – like a view of nature.

- It is thought that visual complexity and interest would help in recovery time from anger or stress (e.g. lowering blood pressure).

- "Colorful" versus dull or institutional is one contrast. May not be an issue of a single color, but the overall color field, relationships between or among colors, etc.

Topics of Inquiry: (cont'd)

Specific topics that could be appropriate for investigation using neuroscience methods in correctional settings

- The impact of daylight and views, including the level of luminance and means of control.

- The effect of exposure to nature (e.g., views of greenery or water) on stress and aggression.

- The impact of the size of space in which one is confined (and the number of people one shares it with), density, crowding, etc.

- The impact of ambient noise on stress and communications.

- The effects of environmental design features on inmate-staff relationships.

- The impact of color on perceptions.

The eventual outcomes from this project are expected to be better, more evidence-based design decisions about correctional environment design and operations, more humane and effective correctional settings, and more satisfied clients of design services.

Alcatraz

Leoben Prison

Ulrich's inquiry:

Can the better design of health care facilities benefit patients, families, staff, and can it reduce health care costs by speeding up recovery?

Ulrich's 1984 study revealed the following findings

- Surgery patients in rooms with windows with views of nature were discharged sooner, encountered fewer complications, and used less medication.

- Ulrich identified noise as a stressor in hospital environments, which has been found to increase heart rate, blood pressure, and other stress indicators. Ulrich recorded high levels of noise during staff changes and machinery movement in intensive care units as high as 95 decibels at times, equivalent to an idling motorcycle. The prevalence of hard surfaces in hospitals comes from the changing nature in the history of hospital use, and is employed in attempts to make a more hygienic health care environment

WORK CITED

Eberhard, John. Brain Landscape: The Coexistence of Neuroscience and Architecture. Oxford: Oxford University Press, 2009. eBook.

Zeki, Semir, and Hideaki Kawabata. "Neural correlates of Beauty." Journal of Neurophysiology. 91. (2004): n. page. Print.

Smith, Kerri. "fMRI 2.0." Nature. 484. (2012): 24-26. Print.

Hutchins, Edwin. "Cognitive Ecology." Topics in Cognitive Science. (2009): n. page. Print.

McCullough, Malcolm. "On Typologies of Situated Interaction." Human-Computer Interaction. 16. (2001): 337*349. Print.

Gibson, James Jerome, 1904-1980. The Ecological Approach to Visual Perception. Boston: Houghton Mifflin, 1979. Print.

Eberhard, John, and Brenda Patoine. "Architecture with the Brain in Mind." Cerbrum. (2004): n. page. Web. 23 May. 2012. <http://www.dana.org/news/cerebrum/detail.aspx?id=1254>.

Wexler, Bruce. "Neuroplasticity, cultural evolution and cultural difference." World Culture Psychiatry Research Review. 11.22 (2010): n. page. Print.

Hauptmann, Deborah. Cognitive Architecture: From Biopolitics to Noopolitics. Architecture & Mind in the age of Communication.

Hauptmann, Deborah. Cognitive Architecture: From Biopolitics to Noopolitics. Architecture & Mind in the age of Communication. Rotterdam: 010 Publishers, 2010. 142-167. Print.

Mallgrave, Harry. The Architect's Brain: Neuroscience, Creativity, and Architecture. West Essex: Wiley - Blackwell, 2010. 1-9, 123-159. Print.

Hilderbrand, Grant. Origins of Architectural Pleasure. Berkley: University Of California Press, 1999. 51-139. Print.

Norberg-Schulz, Christian. Genius Loci: Towards a Phenomenology of Architecture. New York: Rizzoli International Publications, Inc., 1984. Print.

Hauptmann, Deborah. "The Cognitive Turn in the Age of Information." n.d. 81-89. Web. 25 Jul. 2012. <http://www.forumstandaardisatie.nl/fileadmin/os/publicaties/01.6_Hauptmann.pdf>.

Riley, Michael, Kevin Shockley, and Van Orden Guy. "Learning from the Body about the Mind." TOPICS in Cognitive Science. 4 (2012): 21-34. Print.

Juhani, Pallasmaa. The Eyes of the Skin: Architecture and the Senses. West Sussex: John Wiley & Sons Ltd., 2005. eBook.

Eberhard, John. "Applying Neuroscience to Architecture."Neuron. 62. (2009): 753-756. Print.

Anthes, Emily. "Building around the Mind." Scientific American. April (2009): n. page. Print.

John, Marshall, and Fink Gereon. "Spatial Cognition; Where We Were and Where We Are." NeuroImage. 14.s2-s7 (2001): 1-6. Print.

Dubbs, Dana. "Unlocking the Brain for Better Architecture and Design." 360. July (2005): n. page. Print.

Faberstein, Jay, and Melissa Farling. "Neuroscience and correctional facility design workshop: understanding cognitive processes in correctional settings." N.p., Web. 25 Jul. 2012.

Gage, Fred. "Neuroscience and Architecture." AIA 2003 National Convention & Expo. American Institute of Architects. California, San Diego. May 8-10, 2003. Lecture.

Mehaffy, Michael. "The architect has no clothes." Guernica. 19 October 2011: n. page. Web. 25 Jul. 2012.

Rosen, Allyson, Stephen R, et al. "Neural basis of endogenous and exogenous spatial orienting: a functional MRI study.(magnetic resonance imaging)." Journal of Cognitive Neuroscience. March (1999): n. page. Web. 25 Jul. 2012.

Goldhagen, Sarah. "Seeing the Building for the Trees." New York times [New York] 8 January 2012, SR12. Web.

Costandi, Mheb. "NEUROAESTHETICS PROMISES TO REINVIGORATE SCIENCE'S SEARCH FOR A THEORY OF BEAUTY.." SEED. 25 7 2012: n. page. Web. 25 Jul. 2012.

Tomasi, Don. "EVIDENCE-BASED DESIGN IN SCHOOLS: CLASSROOM DESIGN AND ACADEMIC ACHIEVEMENT." TLCD Architecture. N.p., 2010. Web. 8 Aug 2012.

Sternberg, Esther. Healing Spaces. Cambridge: The Belknap press of Harvard University Press, 2009.

Ostwald, MIchael. "The Modulor and Modulor 2." NEXUS NETWORK JOUENAL. 3.1 (2000): 2-3. Print.

Barry, Caswell. "Human brain uses grid to represent space."NAture. (2010): n. page. Web. 20 Aug. 2012.

The American Prison: from the beginning.... The American Correctional Association, 1983. Print.

Foucault, Michel, 1926-1984. Discipline and Punish : The Birth of the Prison. Tran. . Ed. . 2nd Vintage Books ed. New York: Vintage Books, 1995. P. 205

Kliment, Stephen. Building Type Basics for Justice Facilites. Hoboken: John Wiley & Sons., Inc, 2003. Print.
(35) Fairweather, Leslie, and Sean McConville. Prison Architecture: Policy, Design, and Experience. Woburn: Architectural Press,

Fairweather, Leslie, and Sean McConville. Prison Architecture: Policy, Design, and Experience. Woburn: Architectural Press, 2000. 61-73, 89-98.

New Directions in Prison Design. Crown Copyright, 1985.

Miessen, Markus, and Shumon Basar. Did Someone Say Participate?. Cambridge: MIT Press, 2004. Print. p.273-290.