Neural-Architecture: Incorporating clinical expertise in brain-based design principles

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I. ABSTRACT

In order to accommodate the wide range of responses from common and expected to extraordinary and unpredictable, careful on-site observations and measures should be taken in real scenarios. Individuals with a neurological, psychological or psychiatric condition (along with comorbidities) can and often do experience the world through a different lens. Brain-based design principles must therefore reflect the complexity of the human condition in health and in illness. In order to advance our understanding of how architectural form may better serve human function, we must consider not only the neuroscientific data from 'average normal' subjects, but also the findings from clinical patients. A large body of clinical research reveals the neural interactions that underlie the human experience of design. Each person's response to the built environment may change over the course of their life, a day, and even a second as their mental state or medical status may be influenced by external stimuli. Neuroplastic changes may also alter the perception or impact of design with exposure to specific environmental features. Further, we must consider how the complexity of the human condition, including co-occurring (comorbid) diseases, disorders and dysfunctions, may alter the response to design, particularly as the global populous ages, and chronic disorders become increasingly prevalent.

I.1. *Methods*

Neural design principles were derived from clinical experience, literature reviews and discussions with physicians, surgeons, scientists, nurses, specialists, therapists and at several neurology, neurosurgery and rehabilitation facilities in the US, UK, Canada and China. The needs of a patient with a neurological, psychiatric or psychological condition can be difficult to articulate and understand. Changing mental, emotional and physical health status complicate their perspective on their environmental conditions. In order to incorporate this complexity, it is essential that on-site observations, focus groups and meetings bring together clinicians, patients, architects and designers to identify elements that may increase design efficacy, enhance patient outcomes while increasing operational efficiency. The typical on-site walkthrough does not reveal these complex needs. Instead, observation of patients, providers and users must be undertaken to help designers understand how the built environment may be experienced.

I.2. *Process*

Accessible design begins to address the needs of this unique population, but are often limited to mobility issues (ramps and rails) under ADA laws. To meet the needs of a broad spectrum of neural patients in healthcare settings and in our communities, clinically informed design principles must serve those who appear unaffected to those with severe or life-threatening conditions. The complexity of the built environment must address a wide range of mental, behavioral, cognitive and physical issues including schizophrenia, post-traumatic stress, mood, neurocognitive, neurodevelopmental, neuroinflammatory, or neurodegenerative, or neuromuscular and associated medical conditions.

A review of neural science reveals the complex network systems that must be considered (Kandel et al. 2013). Yet, a pragmatic approach may be applied based upon our current understanding of neural systems, interactions and clinical practice. The physics of form (input stimuli) have been shown to yield measurable changes in sensation, thoughts and actions. These relationships, may move our thinking from a generic or standardized programming approach to a multi-user and multi-functional approach. Design that serves the clinical limits or extremes of neural patients, their caregivers and their providers is more likely to meet most people's needs. It may even go beyond the narrow minima required of people performing generic tasks, and provide a space for delight.

I.3. *Application*

Our approach began by reviewing the wide range of neurological, neurosurgical, psychiatric and psychological conditions that may be encountered at a clinical neuroscience facility. Guidelines focused on how design might best support many comorbid medical, physiological, cognitive, sensory, perceptual, behavioral, and mobility conditions. Movement ability can be extremely wide-ranging from able-bodied, to full dependence in a power wheelchair, and some have pain, muscle spasms or fatigue with movement. Visual and acoustic privacy used a sophisticated approach to balance clarity, intelligibility with confidentiality. Consideration was given to limited perception of surfaces, color and contrast; visual distractions, changes in thresholds and surfaces can increase fall risk in this population. Existing guidelines for lighting, based upon the average function of young adults are inadequate. Instead, lighting strategies should offer multiple adjustable zones for different visual abilities, task, and circadian needs. Altered perception or cognition may yield difficulty understanding signage or wayfinding leading to frustration and undue stress. The space needed for providers to safely examine patients with limited mobility was also considered.

I.4. *Conclusion*

Neural design principles may be applied within and beyond healthcare settings to meet the needs of the world's aging populous and the increasing prevalence of neurological disorders. Together, these changing demographics demand that we must design for more than the fit and healthy alone. In collaboration with global clinical partners, we therefore are launching a clinical network to inform neural design principles relevant to industrial, interior, architectural and urban settings.

2. REFERENCES

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3. AUTHOR BIO

Eve Edelstein's neurophysiological research and clinical practice applied novel intracellular, in-vivo, and clinical electrophysiologic techniques to diagnostic assessment of auditory and vestibular disorders of central and peripheral origin in adults and children (National Hospital for Neurology & Neurosurgery, Harvard/MIT Hearing Science Lab, Boston; NASA medical command; etc.). As Fellow of the American Academy of Architecture, is Director of the Human Experience, and the BioAcoustic Neuro Group of the Gadget Lab at Perkins + Will, and is faculty at the NewSchool of Architecture & Design in San Diego, Edelstein leads the Design Health CoLab, participates with the Center for Healthy Environments and the AIA Design + Health Research Consortium. With ANFA and NSAD, Eve developed the Neuroscience for Architecture curriculum, and with the University of California, San Diego created novel virtual visual and sonic simulations that synchronously measure the consequence of design on EEG and human outcomes. With degrees in neuroscience (Ph.D. Institute for Neurology, University College London), Anthropology (UC Berkeley) and Architecture (NewSchool of Architecture & Design), Eve now translates clinical and neuroscientific research into brain-based principles for design in all building types and scales, from rooms to regions, and including workplace, healthcare, educational, science and technology facilities.