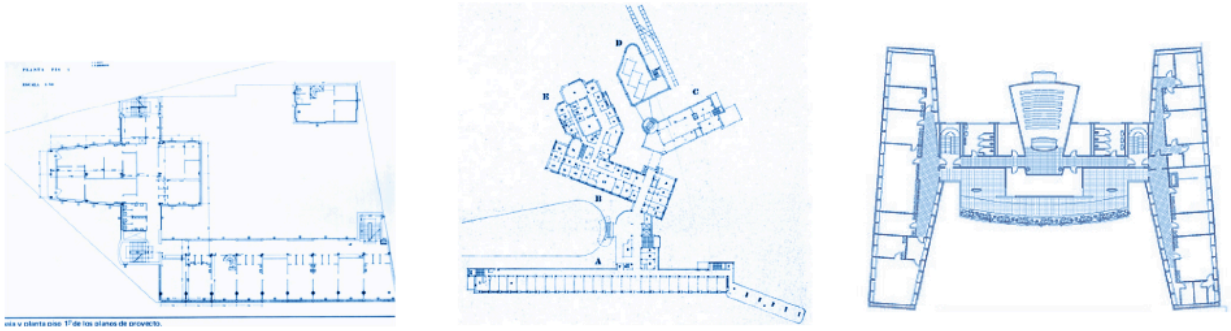
Pablo Ros, Phd candidate at UPC
Brain /Machine Theory

Neuro-Architecture for Fractal Bodies



Dispensario Antituberculoso de Barcelona, Josep Lluís Sert

Paimio Sanatorium, Alvar Aalto

Finsbury Health Center, Berthold Lubetkin

fig. 1 Tuberculosis sanatoriums. From left to right: Dispensario Antituberculoso de Barcelona, Josep Lluís Sert; Paimio Sanatorium, Alvar Aalto; Findsbury Health Center, Berthold Lubetkin

Abstract:

The active collaboration between architects and doctors have radically influenced architecture theories in the last century. The tuberculosis sanatoriums were examples of how ventilation, sun light and hygiene impacted the domestic scale and the organization of the city in the 20th century (fig. 1)

While architects were dazzled by these sterile an rationalized architectures, my thesis inverts this approach using embodied technologies that capture physiological and neural parameters to propose an alternative aesthetic model that fosters the human corporeality and sense interaction for body rehabilitation and interactive space generation.

Introduction:

Fractal bodies are those that, being physically separated, migrate corporal information to other bodies for the generation of interactive patterns through electronics.

Brain Machine interaction (BCI) is emerging as one of the more powerful systems making possible this communication and interaction of separate individuals in distant environments.

Challenged by last year's convergence of mind and technology, The Laboratory for Intelligent Imaging and Neural Computing of Columbia Bio-Medical Engineering, headed by Dr Paul Sajda, joined with The Cloud Lab at the Columbia University

Graduate School or Architecture for the expansion of knowledge frontier of architecture through the application of electroencephalogram technologies (EEG) to the physical environment. By detecting electrical activity in the brain using small electrodes attached to the scalp, brain cells communicate via electrical impulses to the computer accumulating real-live data (fig.2). How brain emulation can import, appropiate, reterritorialize the ideas of neurosciencie to transform this data into physical human interaction and computational generation of the environment?

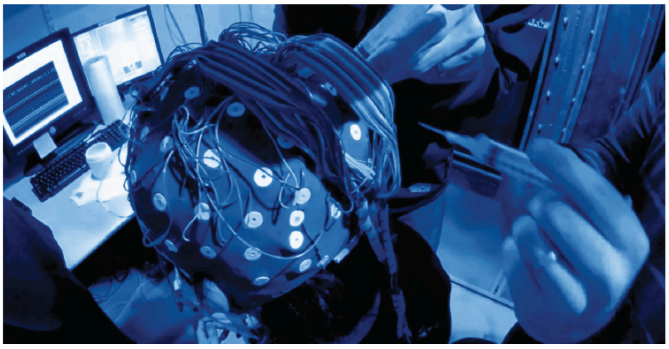


fig. 2 EEG at The Lab for Intelligent Imaging and Neural Computing of Columbia Bio-Medical Engineering.

Methods:

It remains a need for an efficient device and system for a portable, wereable human-machine interface that allows easy and affordable human control of the environment through physiological inputs.

My research developes and designs a spatial platform[1] for the augmentation of the body, the therapy and rehabilitation of the brain altogether in a neuro-responsibe environment that captures and maps the bio-data of the occupant, making the built environment aware of the human neuro-conditions.

This registered platform, called Neuro-Medallion[2], is shaped as a wearable jacket that acquires electrical activity from the skeletal muscles. The jacket processes these bio-data signals to design a space that accelerates and improves the rehabilitation of the patient. While worn, the space inhabitated is controlled by the user's emotions, thoughts and movements, augmenting his capacities and allowing the virtual recovery of lost habilities (fig.3)

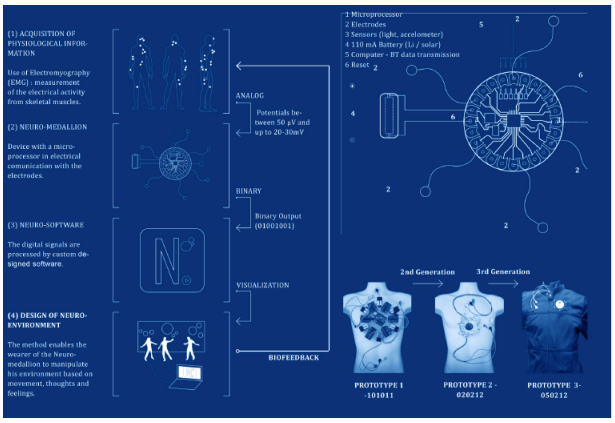


fig. 3 Neuro-Medallion prototypes

When applied to spatial conditions, the room is transformed by this platform into a space of therapy driven by the brain and the body. A new set of rules organize this new space for rehabilitation. The window, so important in curative regimes, is displaced by the lighted projection on an interactive screen that together with holographic projections augments the body; these volatile projections turn into constant visual and kinesthetic transformation of the built environment. The void of the room not only requires ventilation but mantaining flows of data that connect the patient with the physicality of the space without external interferences. Space dimensions are based on projection distances and angles, sensor location and signal coverage (fig.4). This turns into the necessity of revising current rigid hospital layouts (fig. 5) and, in extension, to design new habitational organizations and building typologies. There is the need to adapt them for the inclussion of new technologies for the human and physical environment interaction.

fig. 4 Neuro-Architecture unit prototype

Conclussions

Neuro-Architecture, a dynamic space for fractal bodies using portable technologies for interaction, is still an unexplored area for architectural proposal. The ways humans interact and reflect themselves in the production of subjectivity through the reconfiguration of brain, space and technology, have important implications in creativity that designers should reconsider for new architectural production and the improvement of body and space qualities.

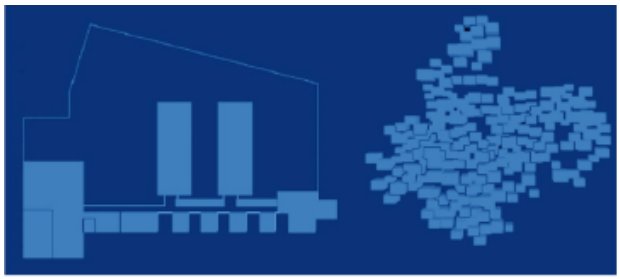


fig. 5 New program organizations (right image: Guttman Foundation Hospital, left image:speculation on a Neuro-Architectural program)

[1] Pablo Ros. Neuro Medallion, Device, System and Method. US Patent and Trademark Office 011827-54599, s. f.

[2] A device for detecting physiological information from the body of a wearer and controlling an environment, comprising: a substrate capable of being removably coupled to a portion of the body of a wearer, at least two electrodes supported by the substrate, the electrodes adapted to detect data signals indicative of electrical activity produced by a muscle of the wearer, a microprocessor in communication with the one or more electrodes, the microprocessor configured to generate processed data signals from the detected data signals indicative of electrical activity produced by the muscle, and configured to transmit the processed data signals to a remote device such that a task can be effected by the remote device.