Wisteria: Emotive Intelligent Architecture as an Embodiment of Human Emotion and Cognition

What if our spaces could convey information about unspoken feelings and could be the extension of mind and body? How can we create a reciprocal relationship between the human mind, body, and the built environment, allowing them to shape one another?

Wisteria is an extension of its visitors' minds and bodies. It is an emotive intelligent installation that performs concurrent responses to people's emotions, based on biological and neurological data. In this project, visitors can change the color and form of the installation using their brains and emotions. We integrated artificial intelligence (AI), wearable technology, sensory environments, and adaptive architecture to create an emotional bond between a space and its occupants and encourage emotional interactions between the two affectively.

Here, space is filled with a forest of cylindrical fabric shrouds that suspend from the ceiling. Upon sensing the presence of an occupant, using a programmable material (shape-memory-alloy), the shrouds begin to fluctuate, expanding and contracting the volume of the space in rhythm and sequence. Embedded within each shroud is an LED that activates with a breathing rhythm synced with the actuation of the SMA. The shrouds are arranged to create a distinct spatial progression and bring forth a heightened perception of scale and awareness of oneself within the space.

Using Affective computing or "Emotion AI," this project created a cyber-physical space that blurs the lines between the physical, digital, and biological spheres. The atmospheric qualities of the space are determined by the occupant's emotions detected in real-time using smart wearable and affective computing algorithms developed by the team. This system translates a set of biometrics (e.g. heart rate, skin electricity, blood volume, and temperature) into emotional categories and changes the shape, light, and color of the space accordingly to moderate the emotion. If stress is detected, space begins to morph; the ceiling rises and expands the interior volume, colors brighten and natural air is introduced, and in the process, an empathetic bond is formed between host and occupant. Wisterias uses real-time emotions from neurophysiological data as the agent of change in the environment.

Wisteria intends to behave as an embodiment of human emotion in the physical and built form. Utilizing a merger of advanced emotion detection systems and smart programmable materials, a new connection is revealed between host and occupant. Within Wisteria, the user is given agency and autonomy over the space through which they traverse, shedding light on the potential of future integrations between architecture and artificial intelligence. Wisteria can be used to express and solicit emotions through non-human representation, becoming an effective tool for the communication of emotions.

Wisteria illustrates how spaces can serve as an interface with emotions. The result is an immersive spatial experience that gives the user a key role by activating the space upon their involvement. Users are given an indication of their emotional and physiological states, and thus a tool to enhance, mitigate, or simply become aware of their emotions. This installation demonstrates how spaces can be controlled through users' thoughts and feelings, becoming living organisms with lifelike behavior learned from users, responding to their needs in real-time. Within this project lies a singular objective; to reconcile the relationship between humans and architecture, and to redefine this relationship as one of emotional empathy and active compassion.

Project Team:
Design: Mona Ghandi, Mohamed Ismail, Shanle Lin, Aisha Marcos
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Programming & Electrical: Marcus Blaisdell, Sal Bagaveyev
Cinematography: Nicole Liu, Mohamed Ismail

Video:
https://www.youtube.com/watch?v=RhOalZiI4ok

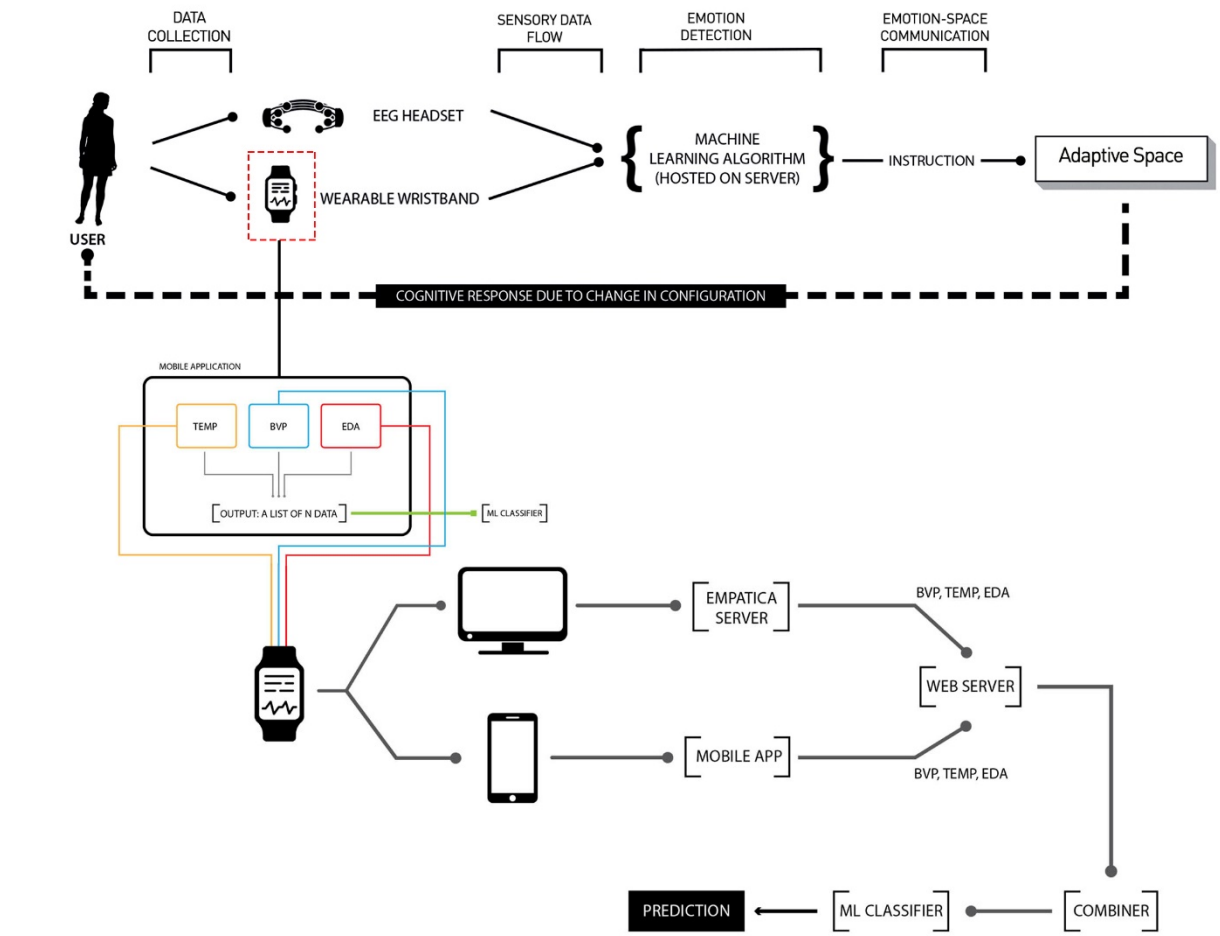
About Morphogenesis Lab:

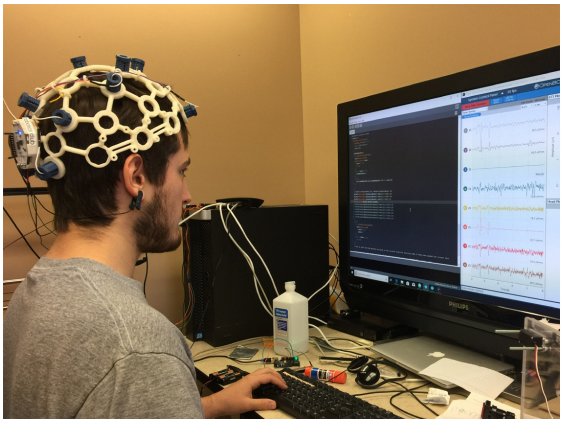
Morphogenesis Lab
The Architecture of Change, Flux, And Adaptation

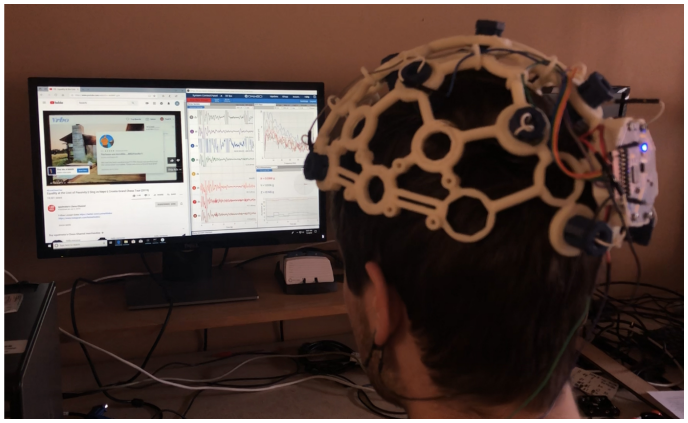
Stable, static, and sedentary; these words often characterize the nature of our surrounding built environment. However, what if we entertain the possibility of an architecture that can possess the qualities of the human state of being; a state of constant change, flux, and adaptation. This is the inquiry posed by the Morphogenesis lab; it serves as the philosophy for its body of work and represents the origins of its name; to "morph," i.e. to change shape, and "genesis" i.e. the beginning. The name describes a process of thinking that places changes in the form of our physical spaces as a function of adaptation to the fluctuating physiological and emotional needs of the inhabitant. At the root of this process of inquiry lies a singular objective; to reconcile the relationship between humans and architecture, and to redefine this relationship as one of emotional empathy and active compassion.

Morphogenesis Lab is an interdisciplinary team working at the intersection of architecture, art, and technology. Using interactive architectural systems, we explore the potential for the built form to exist as an extension of the human body, serving as the embodiment of our collective needs and desires, from the physical to the psychological.

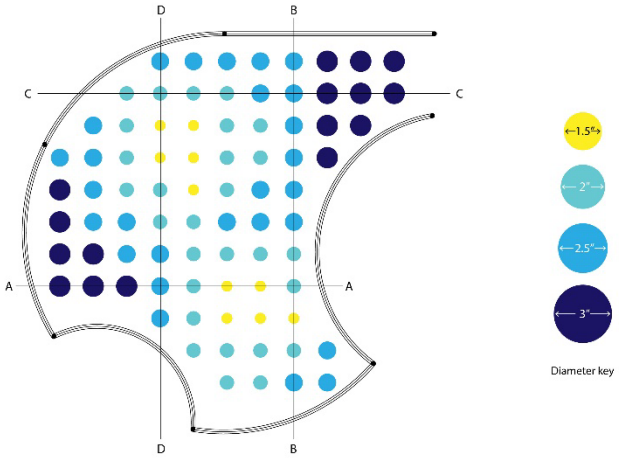
Morphogenesis Lab focuses on "Architecture of Emotive Intelligence," cyber-physical adaptive spaces that can respond to the user's physiological and psychological needs based on the biological and neurological data. It examines the role of Artificial Intelligence, machine learning, and the smart adaptive environment in improving the sustainability and well-being of the buildings. Morphogenesis Lab attempts to create spaces that can learn from users' behavioral patterns in real-time and change the space autonomously based on the users' needs. This reduces user's anxiety and depression, enhances environmental quality, and promotes more flexible, human-centered designs. These responsive spaces can contribute to users' and society's well-being and help people with physical and mental disabilities to have a greater role in shaping their built environment.



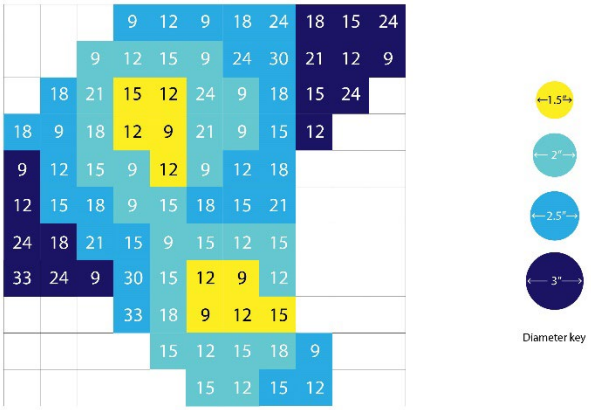




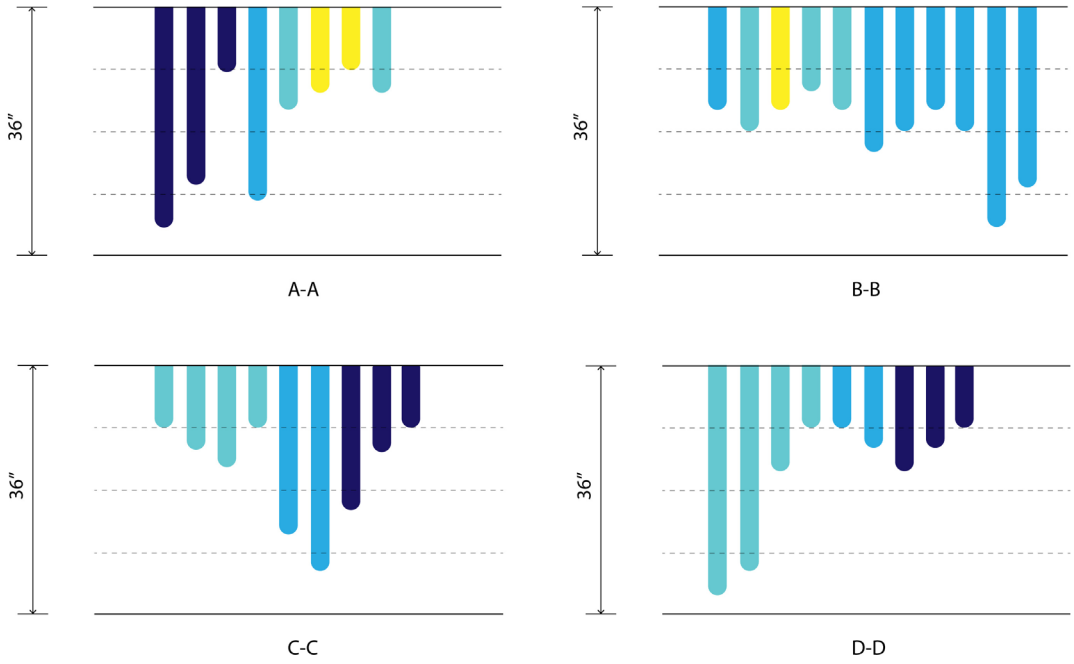
Flowchart showing emotional state detection based on biological and neurological data.



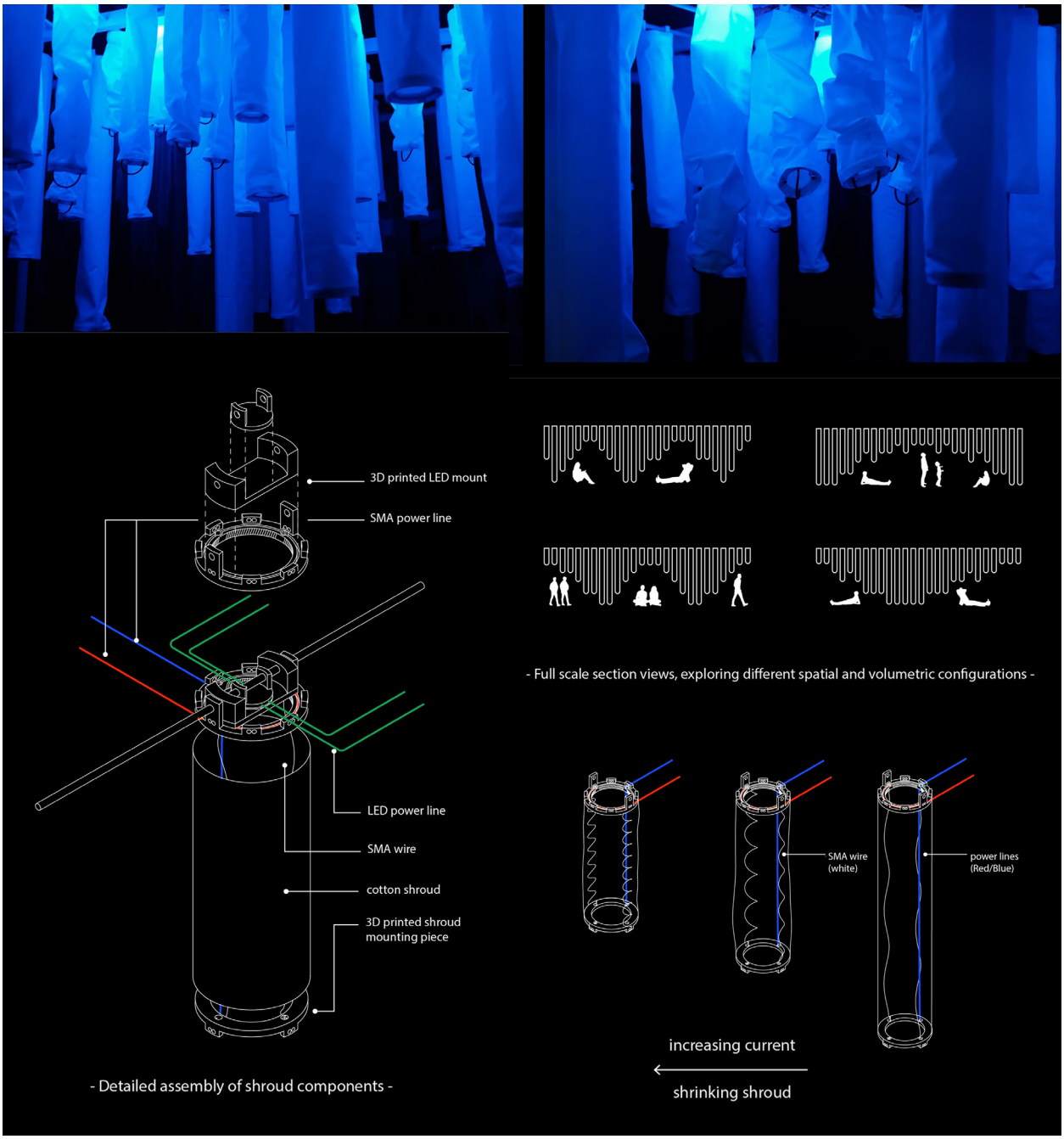
Plan view showing the distribution of shrouds with varying diameters



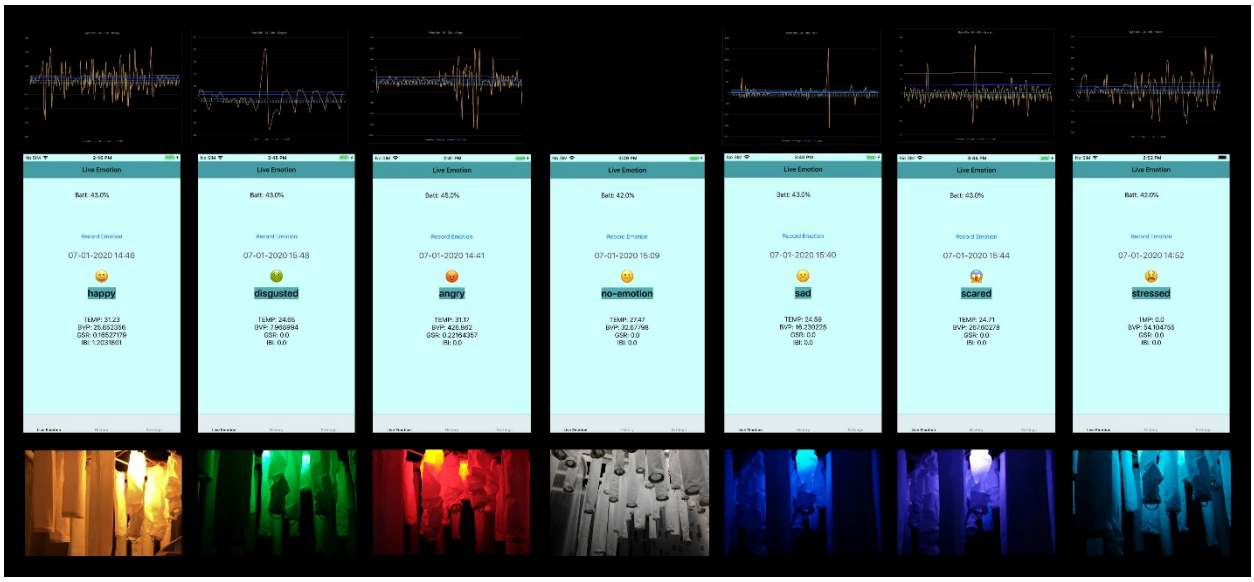
Plan View Mapping the shrouds, with values indicating shroud length in inches



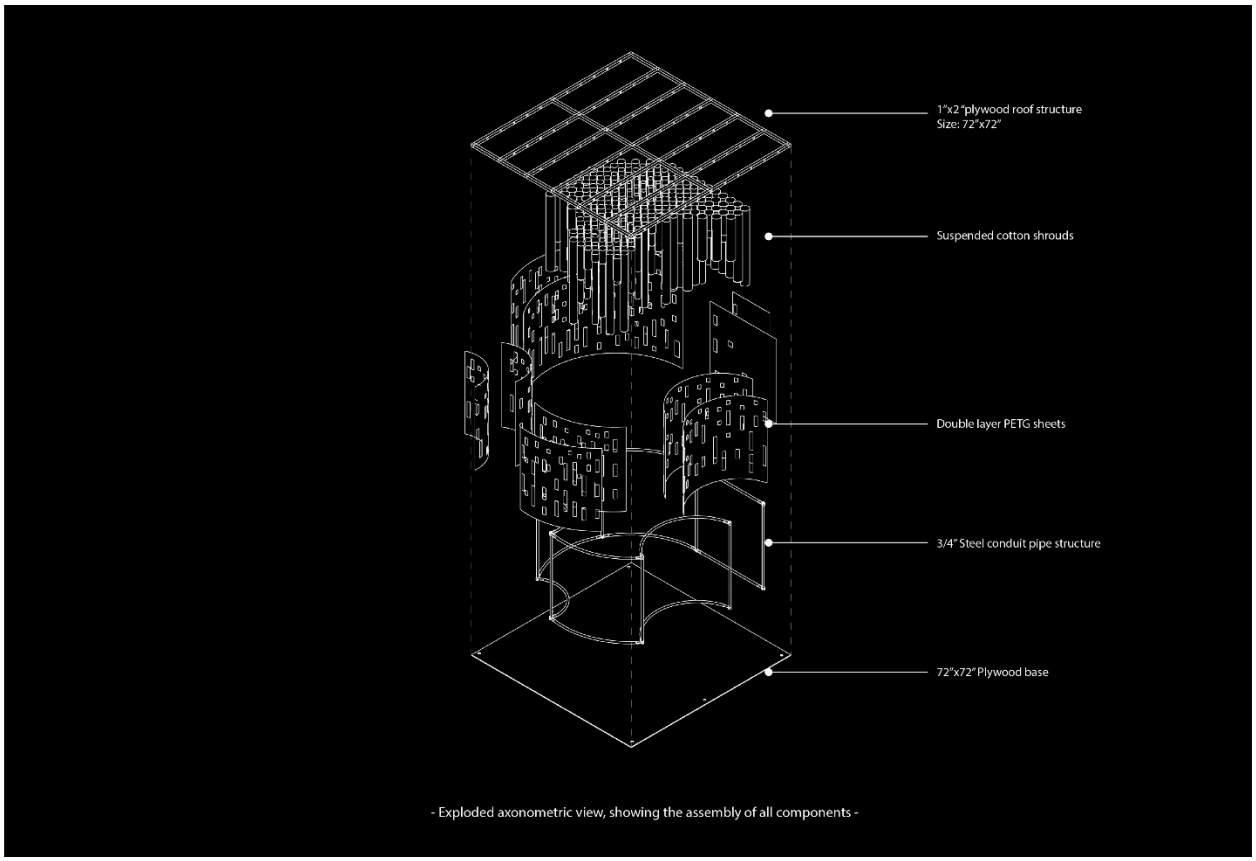
A selection of schematic sectional views showing changes in Spatial Volumes



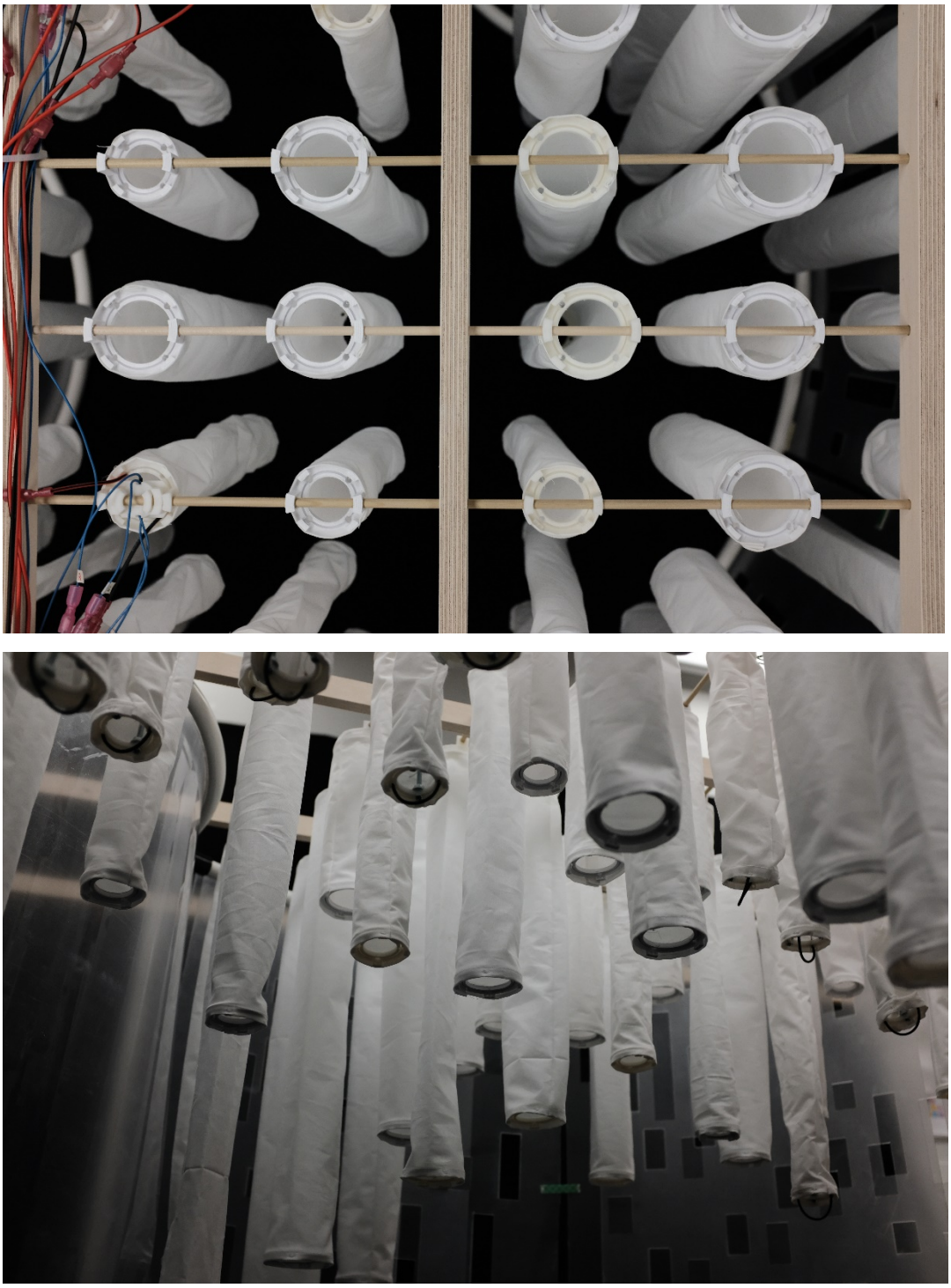
Detailed assembly of the shrouds, with structural and electrical components (left), exploring different spatial and volumetric configurations (Top right). Diagram illustrating the relationship between increasing current and shroud actuation (bottom right).



Mapping biodata to the seven distinct emotions (top), screenshots of the phone app (middle), installation color and form changing based on detected emotions (bottom).

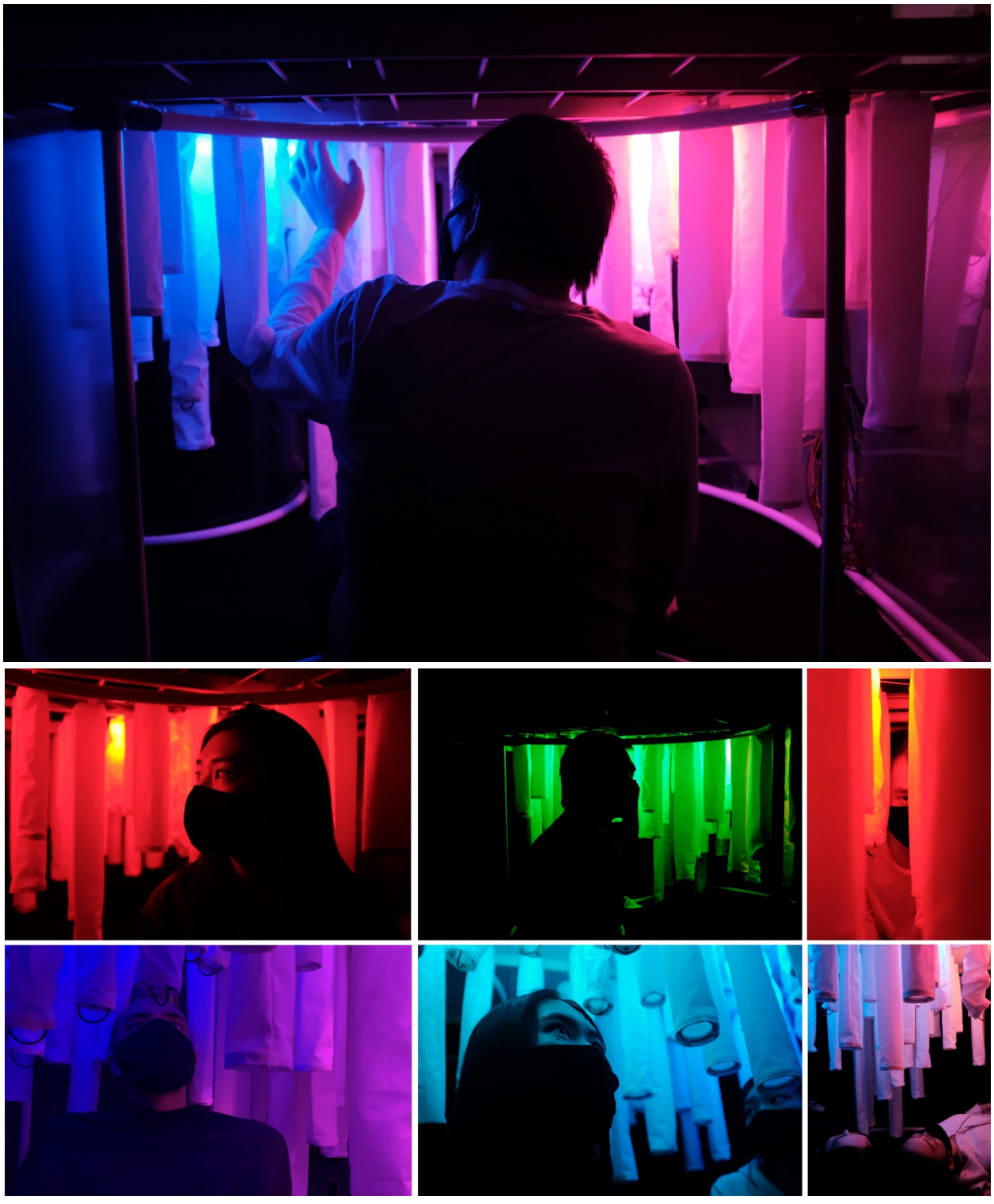


Exploded axonometric view, Showing the assembly of all components.



Shrouds installation details. 3D printed rings for shrouds that host the wires and LEDs and connects the shrouds to the ceiling. The project contains both powered, and un-powered shrouds. The un-powered shrouds do not contain SMA wire and do not change their shape. The powered shrouds are arranged in a pattern.

Interior views showing real-time communication between detected emotions in real-time and the resulting spatial effect.



A selection of views showing the immersive interaction of participants with the installation. Upon sensing the presence of an occupant, using a programmable material (shape-memory-alloy), the shrouds begin to fluctuate, expanding and contracting the volume of the space in rhythm and sequence based on the detected emotion.