

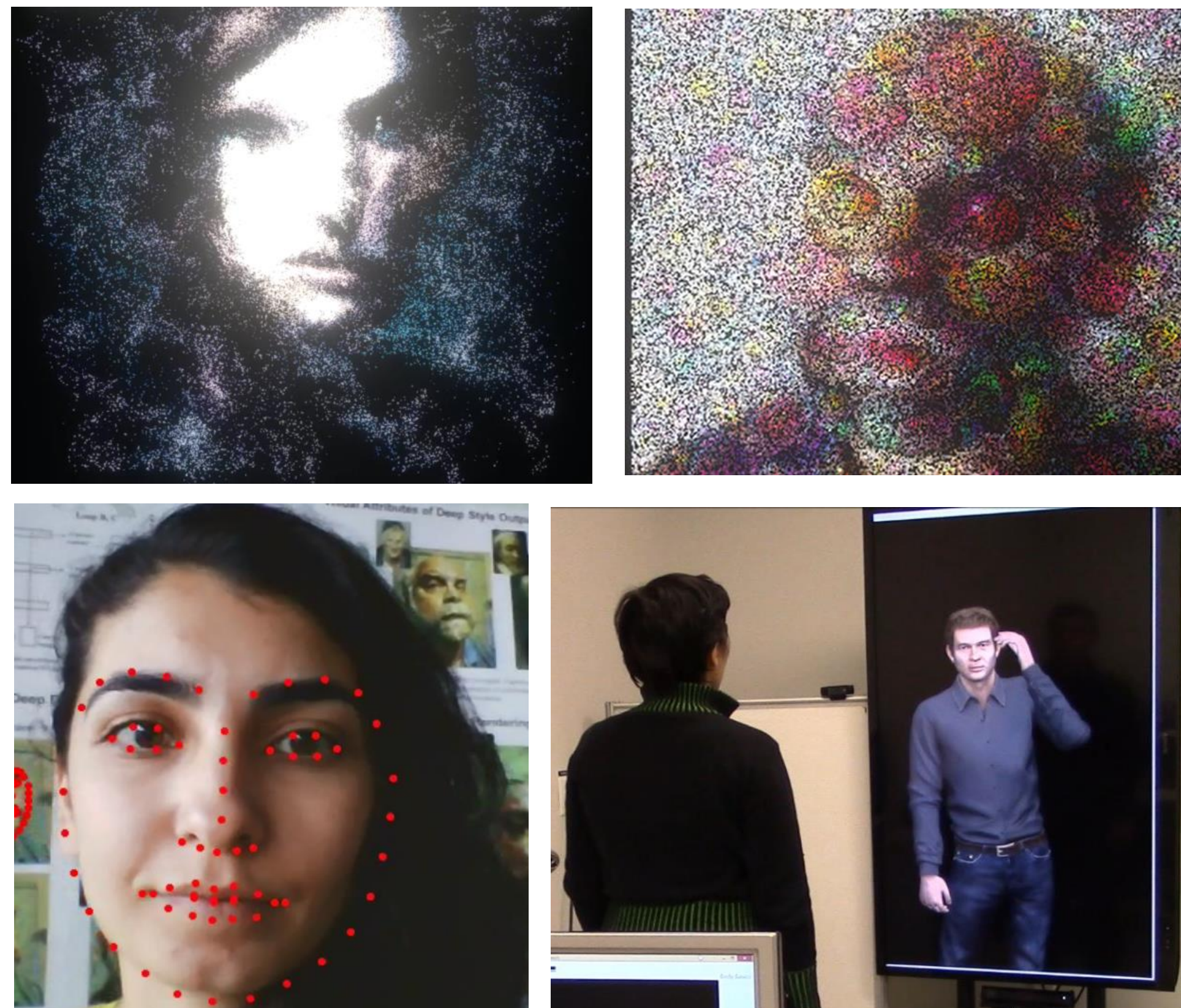
Situating Expressive Arts Therapies in Bio-responsive VR Spaces

In our research, we are critically examining the role of virtual and immersive spaces as a therapeutic space from the perspective of traditional expressive arts therapies and our cognitive AI research in biofeedback.

We are specifically interested in the intersections between the immersants, the real-virtual environments and the generated “experiential space” visualized through organic, amorphous 3D forms and environments. This real-time bio-responsive “experiential space” has potential in creating a variety of application spaces including:

stress relief : meditation : well-being

We demonstrate our bio-responsive Virtual Reality (VR) framework that evolves and reflects the immersant's physiological data in a tightly coupled real-virtual experience.



AI Art and VR Avatar Visualized Through Bio-Responsive Systems

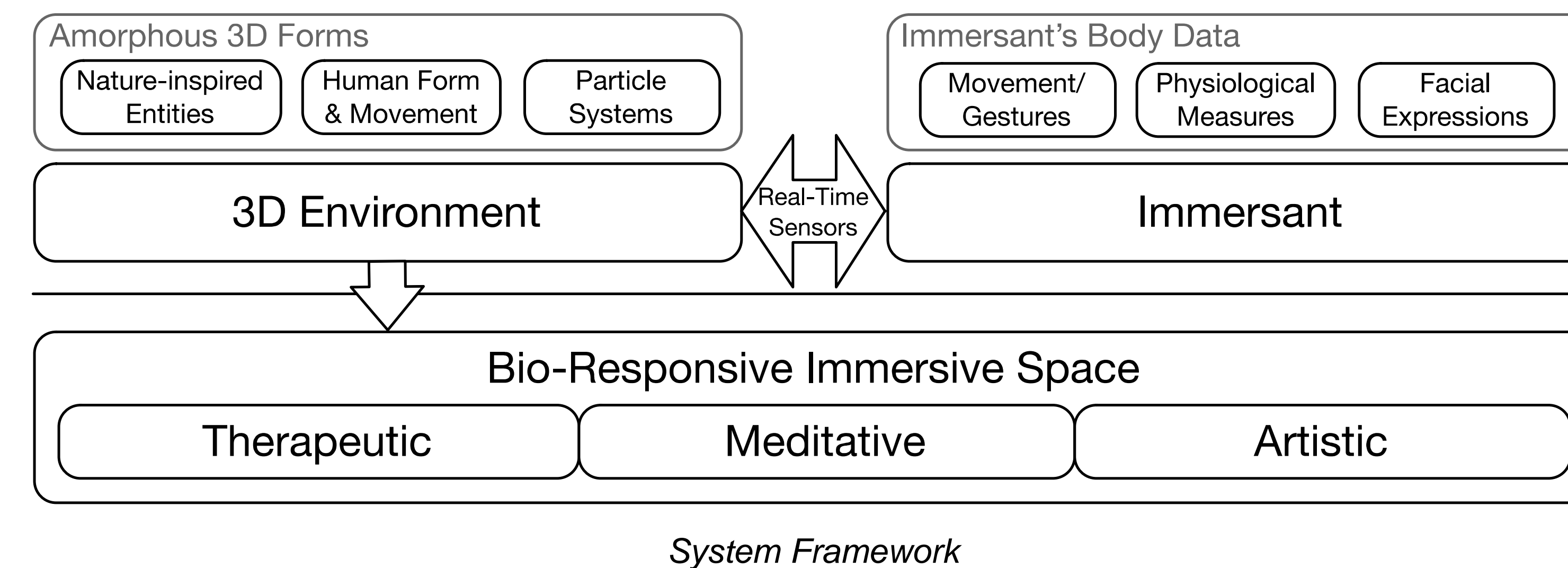
Expressive Arts Therapies

Expressive arts therapy is defined as the therapeutic use of the art, music, dance/movement, drama and poetry/writing. In the U.K., the 4 recognized expressive arts therapies are: Art Therapy, Music Therapy, Drama Therapy and Dance Movement Therapy (Meekums 2002). Expressive arts therapy is linked to world healing practice traditions and cultural precedents where indigenous healers or shamans might sing, dance, make images, or tell stories in their healing rituals (McNiff, 1981).

Bernie Warren emphasizes in the book *Using the Creative Arts in Therapy: A Practical Introduction* (2003, p. 5) that there should be a shift in our thinking from ‘arts as therapy’ to ‘arts for health’ with the emphasis on indulging in the actual creative processes.

McCraty, R. (2015) Heart-brain neurodynamics: The making of emotions. In *Heart: The Neuropsychologist's Handbook* pp. 76-110.
McNiff, S. (1981) *The Arts and Psychotherapy*. Charles C. Thomas, Springfield.
Meekums, B. (2002) *Dance Movement Therapy: A Creative Psychotherapeutic Approach*. SAGE Publications, London.
Salevati, S., & DiPaola, S. (2015) A creative artificial intelligence system to investigate user experience, affect, emotion and creativity. *Electronic Visualisation and the Arts (EVA2015)*, pp. 140-147.
Song, M., & DiPaola, S. (2015) Exploring different ways of navigating emotionally-responsive artwork in immersive virtual environments. *Electronic Visualisation and the Arts (EVA2015)*, pp. 232-239.
Warren, B. (Ed.) (2003) *Using the Creative Arts in Therapy: A Practical Introduction*, 2nd Edition. London.

Proposed System Framework



There are 3 components in our current system:

1) Immersant's Body Data

This component acquires the immersant's psychophysiological data through various devices such as the Microsoft Kinect, Leap Motion gestures, Empatica E4 biosensor watch and HeartMath HRV Sensor. Through these sensors, users' body data such as gestures, body movements and biofeedback data are fed into the system in real-time. The two biofeedback measures we are specifically implementing our system on are the EDA and IBI. The Empatica E4 biosensor watch is a medical grade wireless biofeedback device capable of reading continuous HR, BVP, EDA and peripheral skin temperature. The raw data is wirelessly sent into Unity3D VR system.



Microsoft Kinect



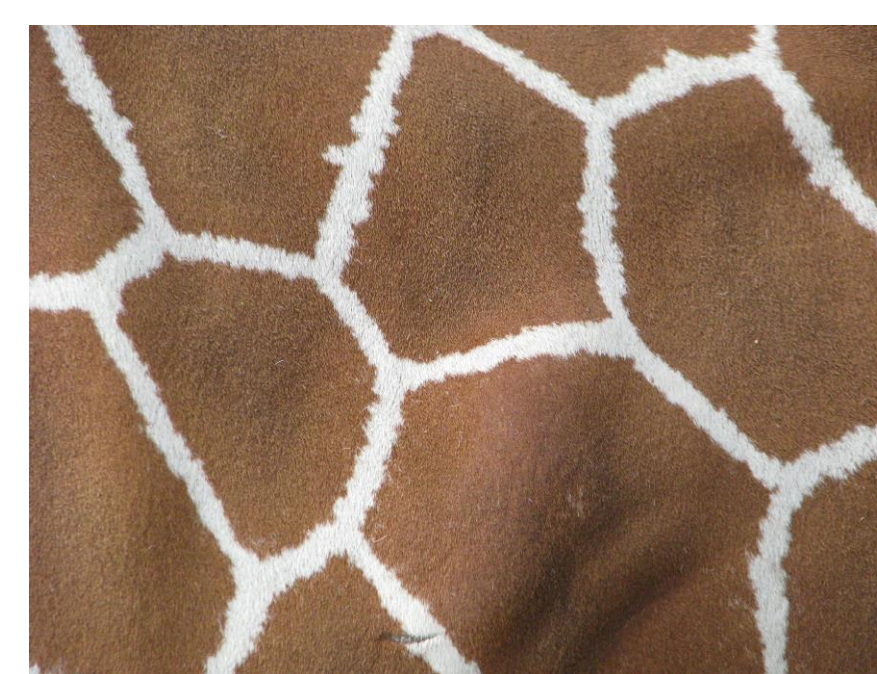
Empatica E4 Biosensor Watch



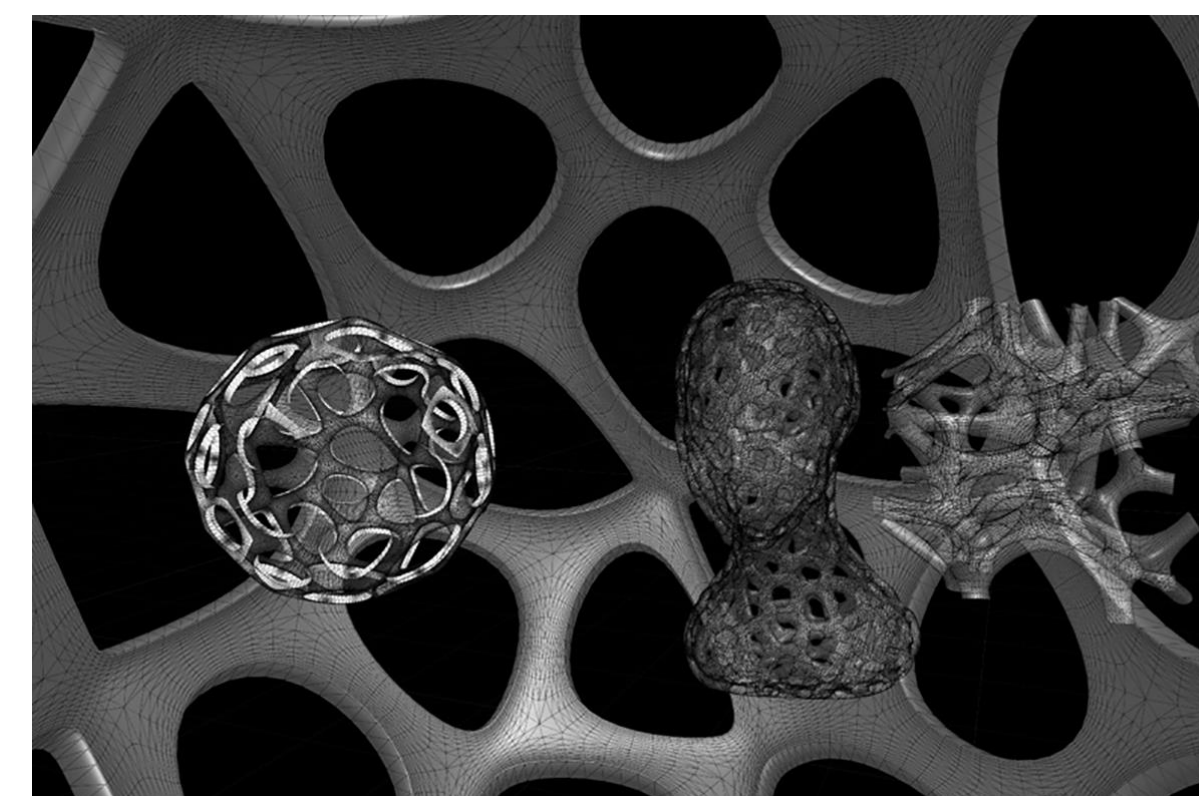
HeartMath Sensor

2) Amorphous 3D Forms

One of the main research areas of our lab is in generative AI art systems and real-time behavioural systems for 3D avatars, we have been extending our research into 3D immersive space (Song & DiPaola 2015) with various 3D forms in conjunction with real-time biofeedback loops to control the VR. Working from this research as a foundation, we have taken inspiration from painterly arts, nature-inspired cell structures, the human form and non-rigid particle entities as the basis for the generation of the 3D VR space.



Voronoi Structures on Giraffes
(Image from Pixabay)



Procedurally Generated
Voronoi Structures



Voronoi Structures on
Dragonfly Wings (Image from
Pixabay)

3) Bio-Responsive VR Environment

Our bio-responsive VR and immersive space is created and displayed on the HTC Vive HMD or a large projection screen or monitor. Both displays require physical space for the immersant to move around. The 3D visuals are controlled through direct mapping of the sensor data to the 3D forms in Unity3D.

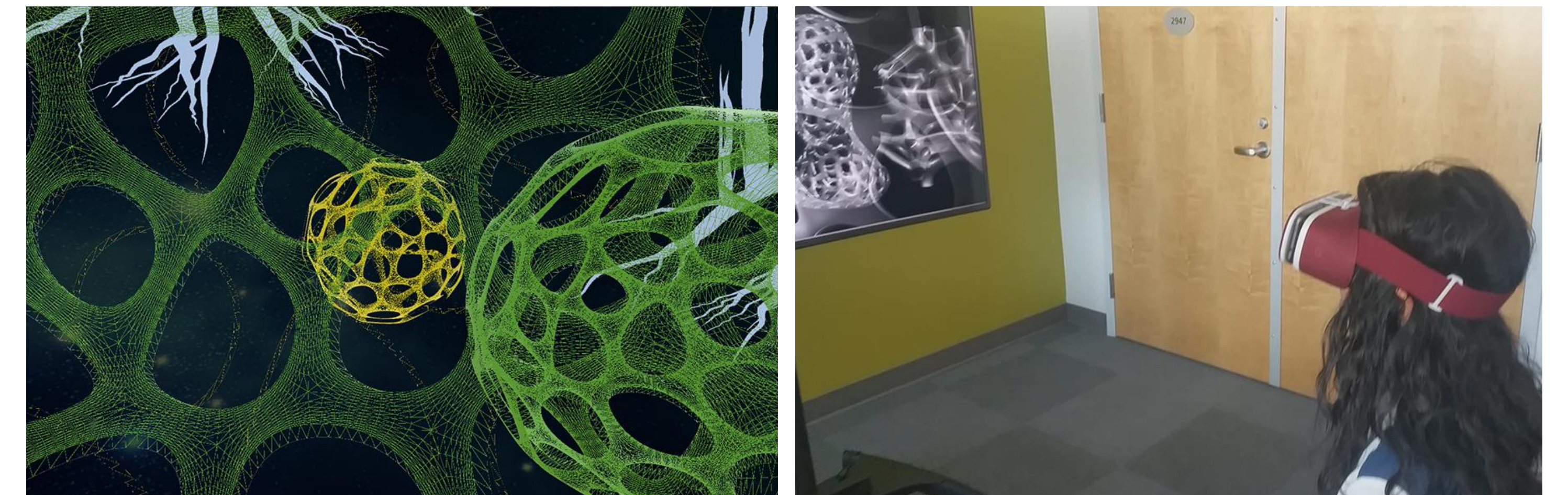
System Prototypes

Multiple virtual and immersive systems are currently being developed under our framework for therapeutic, meditative and artistic purposes. We present three prototypes here:

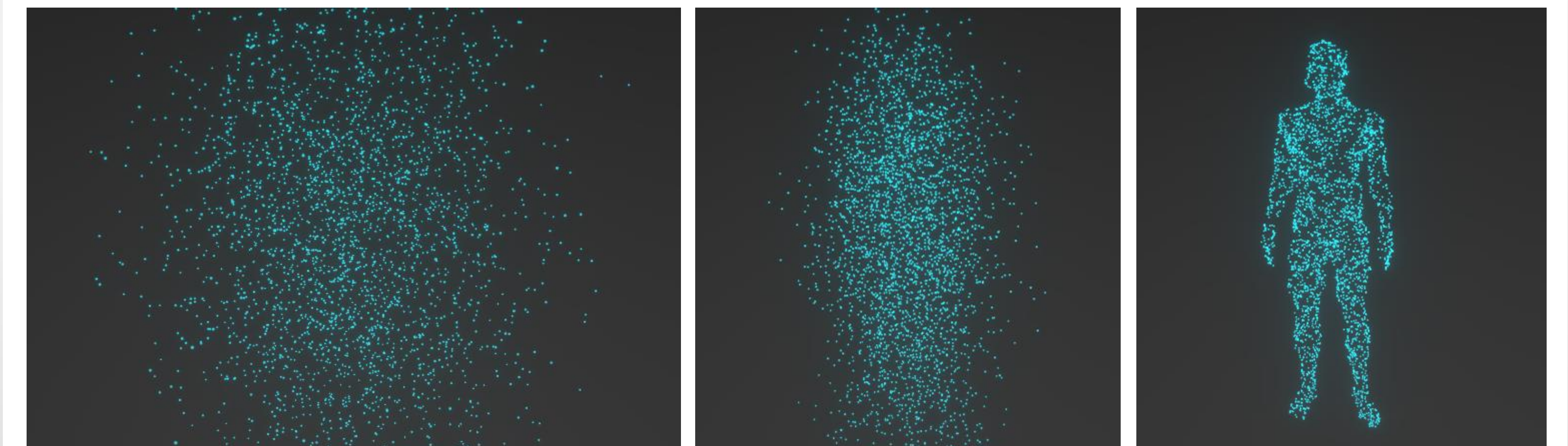
1. Real-Virtual Installation: multiple people (up to 6 at any given time) in the interactive space, the human forms on the screen will start to reacting to the users presence.



2. Virtual Bio-Responsive Voronoi Cells: explores experiential bio-responsive cell structures in immersive VR where immersants are encapsulated inside Voronoi-cell structural domes that are constantly pulsating to the immersant's own heart rate.



3. Breathing/heart rate Projection of You : The immersants sees immersive cloud-like organic space where the particles move to one's HRV and breathing to gradually form into the form of the immersant, guiding forms of mediation and relaxation.



Conclusions and Future Work

- Our system draws from traditional expressive arts therapies as well as from iVizLab's cognitive AI research
- User studies showed that the bio based visual generated through our AI system elicits strong and repeatable user emotions (Salevati & DiPaola 2015)
- Our VR work with stress, meditation, well-being by immersing in our art / nature based VR that bind via heart rate, ... to amorphous characters & environments, constantly evolving via psychophysiological streams
- We will be refining our HRV research on emotion / heartbrain connection from the Heart Math Institute (McCraty 2015)

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