Viewpoints

Close Encounters with Art of Neuroscience 14th Edition

Jacob A. Westerberg, Charlotte Daemen, Eline Feenstra, Rasa Gulbinaite, Kalliopi Ioumpa, P. Christiaan Klink, and Sumiya Sheikh Abdirashid

Art of Neuroscience, Netherlands Institute for Neuroscience, Royal Netherlands Academy of Arts and Sciences, Amsterdam 1105 BA, The Netherlands

Neuroscience research affects individuals in diverse and profound ways, not only in the many laboratories and imaging facilities worldwide but also far beyond them. Often, these experiences inspire creative expression, leading to powerful artworks with beautiful and thought-provoking stories to tell or ideas to reflect on. Since 2011, the Netherlands Institute for Neuroscience—an institute of the Royal Netherlands Academy of Arts and Sciences (KNAW)—has hosted an international art competition to showcase artworks inspired by neuroscience. Everyone from scientists to professional artists to individuals with a neuroscience encounter in their daily lives can submit their work. The independent jury selects a winner for the competition and several honorable mentions. In the 14th edition of "Art of Neuroscience" (AON), we had submissions from six continents in a wide range of artistic forms: painting, drawing, sculpture, dance, video, and applied arts, to name a few. Here, we celebrate the artworks submitted in this edition and congratulate the winners and honorable mentions while sharing stories that inspired their work. Below, you will find the work and stories as told by the artists. With each artwork, we include commentary from the jury detailing their impressions. Without further delay, we present the winners and honorable mentions from the 14th edition of AON.

What Is Art of Neuroscience?

Art of Neuroscience (AON), founded at the Netherlands Institute for Neuroscience, held its first competition in 2011. In the 13 years since, the competition has grown from an institutional passion project into an international art competition attracting the attention of scientists and artists alike. Each year, AON puts out a call for artwork submissions. Independent jury members from the arts and sciences are invited to participate in a collaborative judging process. These jurors select a winner and four honorable mentions who all receive a cash prize. AON is coordinated by a small team of volunteers at the Netherlands Institute for Neuroscience. You can find out more about the competition at aon.nin.nl and keep up to date with future editions by following us on X (@ArtNeuro), Instagram (@artofneuroscience), Facebook (Art of Neuroscience), and LinkedIn [Art of Neuroscience (AON)]. If you are interested in supporting the competition, please reach out to the current General Coordinator (aon.coordinator@nin.knaw.nl) for more information.

AON 2024 Winner: Close Encounters with Inner Aliens

Hung Lu Chan—Independent Artist

hungluchan.com

Artist Description: With fMRI and ChatGPT, "Close Encounters with Inner Aliens" (Figs. 1, 2, Movie 1) delves into our alien imaginings personally and collectively, applying guided meditation to both humans and AI. It visualizes aliens from human and artificial inner worlds through a liminal space, encouraging audiences to explore inner aliens and examine their biases toward the unknown.

For centuries, humans have been perceiving other worlds by imagining aliens, from zombies and Martians to other extraterrestrial beings. Gradually, these science fiction entities have gained an impact on our sociopolitical perceptions of otherness. But our imagination of aliens is largely based on projecting our own biases, emotions, and desires into the unknown. In other words, aliens begin within us. Even though the advancement of technology has demystified many imagined figures, our inner aliens have never ceased, but evolved along with human nature. So why not turn the perspective around, and for once not look at the universe searching for the unknown, but investigate our internal aliens through a special mix of guided meditation, AI neural networks, and cognitive neuroscience?

Delving into various interpretations of aliens, Close Encounters with Inner Aliens highlights how we visualize otherness by looking inside ourselves and pondering other worlds within. It merges spirituality and science to transform alien imagination into a mindfulness practice, challenging our stereotypes about aliens rooted in our imagination and perceptions. By conducting guided meditation about alien encounters with individuals and an AI, this project seeks to explore this internal phenomenon both personally and collectively. Analyzing fMRI scans of the early visual cortex, a region linked to mental imagery, we reconstruct individuals' internal representations of aliens across various cultures, genders, and ages (Shen et al., 2019; Koide-Majima et al., 2024). Also, we examine how science fiction shapes our perceptions of aliens through ChatGPT and Midjourney, AIs that reflect our extensive collective knowledge and biases toward aliens.

By applying techniques from both neuroscience and computational modeling, this project creates a liminal space that visualizes

Figure 1. In this liminal space, audiences will experience three distinct phases of encountering aliens. First, they will appreciate the inner aliens from the imaginations of four participants—three humans and one AI—through projection and dialogue. The projection features inner alien images reconstructed by an fMRI scanner. Meanwhile, the dialogue, in which audio is integrated with a tapestry displaying four participants' neuroimages, involves them discussing their interpretations of aliens. Second, the audience will encounter the inner aliens through their mind's eye. By wearing headphones and following the imagination guide, they can visualize their own alien entity and landscapes from within.
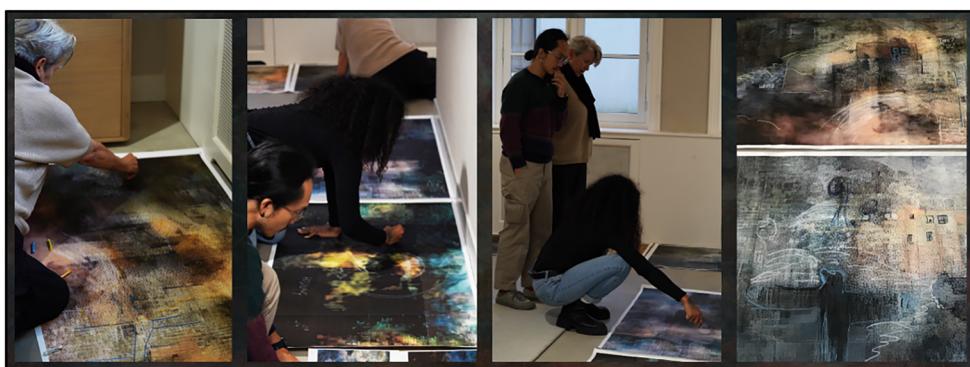
Figure 2. As the reconstructed images from participants are abstract, the artist hosted a workshop with the participants to discuss what they perceived from the scans and transformed their inner aliens into pillows displayed in the liminal space. Surprisingly, all the participants can easily point out where their alien entities and landscapes are revealed and located on their abstract scan outcome. This finding, in a way, echoes the idea mentioned by the collaborated neuroscientists that our perceptions of the external are connected to our imagination of the internal.

aliens from the diverse minds of both humans and AIs. This outcome invites audiences to appreciate others' inner aliens and introspect about their cognitive bias of the unknown.

This work was produced in collaboration with the Predictive Brain Lab at the Donders Institute for Brain, Cognition, and Behaviour at Radboud University in Nijmegen, Netherlands,

Movie 1. Introduction and overview of Close Encounters with Inner Aliens. [View online]

and the MU Hybrid Art House in Eindhoven, Netherlands. Contributors to the project include F. de Lange, F. Bouwkamp, M. Ekman, A. Spaninks, V. McKenzie, R. Tsai, S. Chang, and S. Yang. This project was supported by the Bio Art & Design Award, MU Hybrid Art House, Predictive Brain Lab, and the Donders Institute for Brain, Cognition, and Behavior. More details and images from the work can be found on the artist's website.

Juror Comments: "We were extremely impressed by the depth and breadth of the winning artwork 'Close Encounters with Inner Aliens'. The work was a deep collaboration between science and art. The initial data set of 'aliens' were created using several AI technologies, and then fMRI was used to first record how participants' brains reacted to a set of images. The participants were then asked to imagine 'alien landscapes'. Those were then visually rendered based on which areas of the brains lit up as compared to those which lit up to the initial set of images. I've heard about this technology but have never seen it used in art before. The concept of the work deals with notions of bias in both AI and humans, and to top it off the final installation also included a guided meditation!"

Honorable Mention: AXIAL T1

Diana Zipeto—Independent Artist
   dianazipeto.com

Artist Description: The human body is where we live our whole lives; it is both fascinating and terrifying to look at. Disease can be an isolating experience in a society that often wants to push it away. I'm interested in creating spaces where people can spend time with the reality of disease and the complex feelings that surround it.

This image (Fig. 3) is part of a painting series based on the MRI scans that led to my father's Alzheimer's diagnosis. Painted in black, white, and silver, they are larger-than-life renderings of medical imagery that offer an impossible view inside my father's brain. Attached to the paintings with magnets are torn strips of canvas and pieces of my father's hardware collection, which he meticulously saved and used over many years. These jars of metal pieces fascinated me as a child and hint at both the magic and care that parents provide for their children.

I have recently become interested in tearing the canvas after the paintings have been completed. This made sense to me when I thought about what Alzheimer's does. We all spend our lives caring for our brain, building our brain, optimizing our brain—and then the disease slowly destroys it, causing tangles and plaques. Similarly, making a painting takes hours, days, and weeks of time and we try to make it as finished as possible. Destroying areas in the painting felt like a way to describe the process of disease, and the path all our lives take at some point.

Disease without cure can make us want to do something, even when there is nothing to be done. Finding a way to sit with the person, the disease, and our feelings without pushing any of it away is a challenge and a calling. I believe that looking closely, collectively grieving, and acknowledging our helplessness can help us move towards a place of acceptance. Opening ourselves up to the deep brokenness and deterioration that happens in a human life can be, in the end, what repairs us.

Jury Comments: "AXIAL T1 is a powerful painting and mixed media work. It tells the story of the artist's father's Alzheimer's diagnosis and is based on the MRI scans that led to his diagnosis. The tearing of the canvas represents the destructive effects of the disease and pieces of the artist's father's actual hardware collection represent notions of care. In many ways it's a simple piece but it takes a great deal of accomplishment and confidence to make something that communicates both the emotion and the science of Alzheimer's disease in such a clear and engaging way."

Honorable Mention: Vagustoff: The Brain–Heart Connection

Kaia Sargent—PhD Student, University of California, Los Angeles
   Adam Hersko-RonaTas—Independent Artist
   kaiasargent.com
   antennarosa.com

Artist Description: "Vagusstoff" (Fig. 4, Movie 2) parallels our recent research demonstrating that cardiac activity can modulate neural oscillations (Sargent et al., 2024). There is an elegant organization to the rhythms of the brain and body. Scientific description is of course critical to understanding these processes, but music is perhaps better suited to convey the harmonic relationships and inherent beauty of human physiology.

As I worked on my research, I wanted to hear what heart and brain rhythms sound like as they interact. I built synths that oscillate at the relevant frequencies [theta (6 Hz) and high-frequency heart rate variability (0.3 Hz)], which can be heard as distinct "pulses" in this piece. The sounds eventually evolved into a full
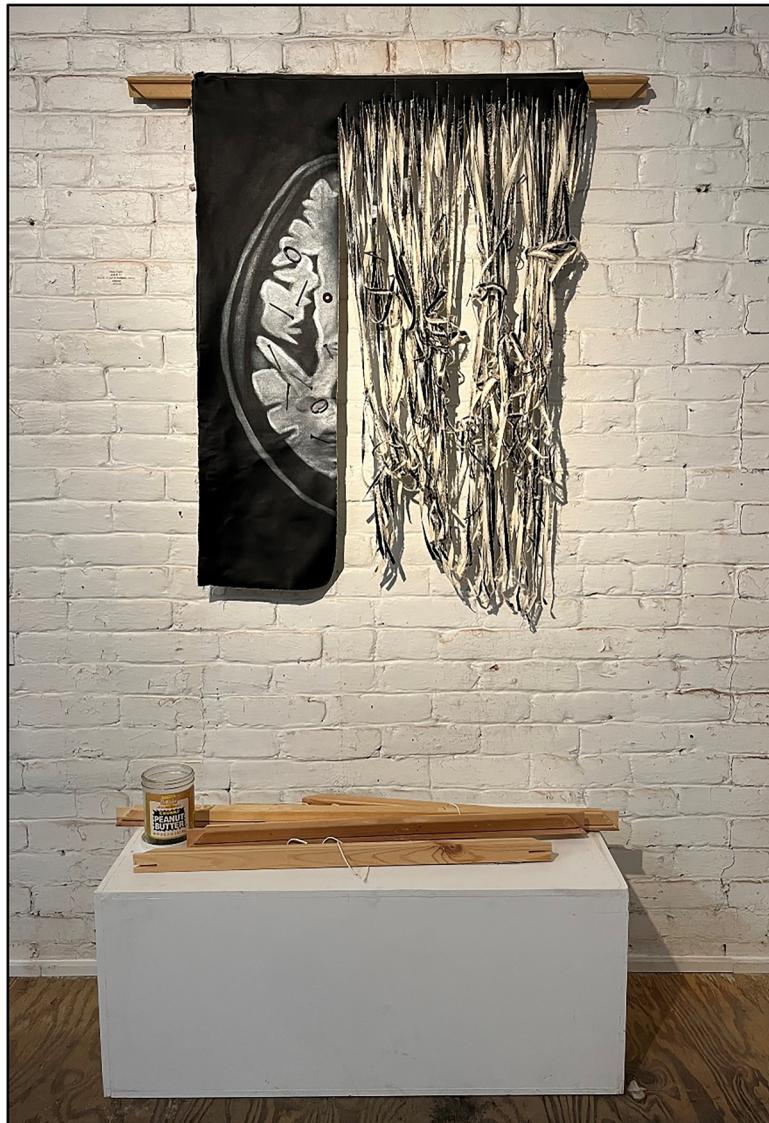
Figure 3. Display of AXIAL T1, one example in a series of artworks that reflect on a personally impactful set of MR scans.

composition—a musical homage to Otto Loewi's original discovery of the chemical connection between the brain and heart (Loewi, 1921).

Otto Loewi came up with the idea for his famous "frog heart" experiment in a dream, and the lyrics of this piece are based on a quote about his experience:

On mature consideration, in the cold light of the morning, I would not have done it. After all, it was an unlikely enough assumption that the vagus should secrete an inhibitory substance; it was still more unlikely that a chemical substance that was supposed to be effective at very close range between nerve terminal and muscle be secreted in such large amounts that it would spill over and, after being diluted by the perfusion fluid, still be able to inhibit another heart.

Jury Comments: "Vagusstoff translates complex physiological interactions between the brain and heart into beautiful images and sound, making scientific phenomena both tangible and emotionally resonant. The thoughtful use of media reflects the harmony inherent in biological systems but also pays homage to Otto Loewi's pioneering work. This piece stands out for its depth, creativity, and interdisciplinary insight, offering us a unique perspective on the human body's intricate connections."

Honorable Mention: Ecotones of the Mind

Mar Estarellas—Postdoctoral Researcher, University of Cambridge
Antoine Bellemare—Postdoctoral Researcher, Bard College and University of Montreal
marestarellas.com
kairos-creation.org

Artist Description: "Humans and ecosystems are of the same kin. Here, we portray the ecotones of the mind as latent morphologies, as hidden sources of life and abundance. In the beauty of the cyber poetics lie diffused entities reflecting new forms of reciprocal embodiment. May the mirror of nature guide us through the richness of our communion, embracing the responsibility and care of a loving relationship. May the soft cyclical beauty tend for our deep belonging, hopeful whispers of intuitive wisdom. Gratefulness will be our first step forward, in the rainforests of the mind, even when the chiaroscuro imprints our
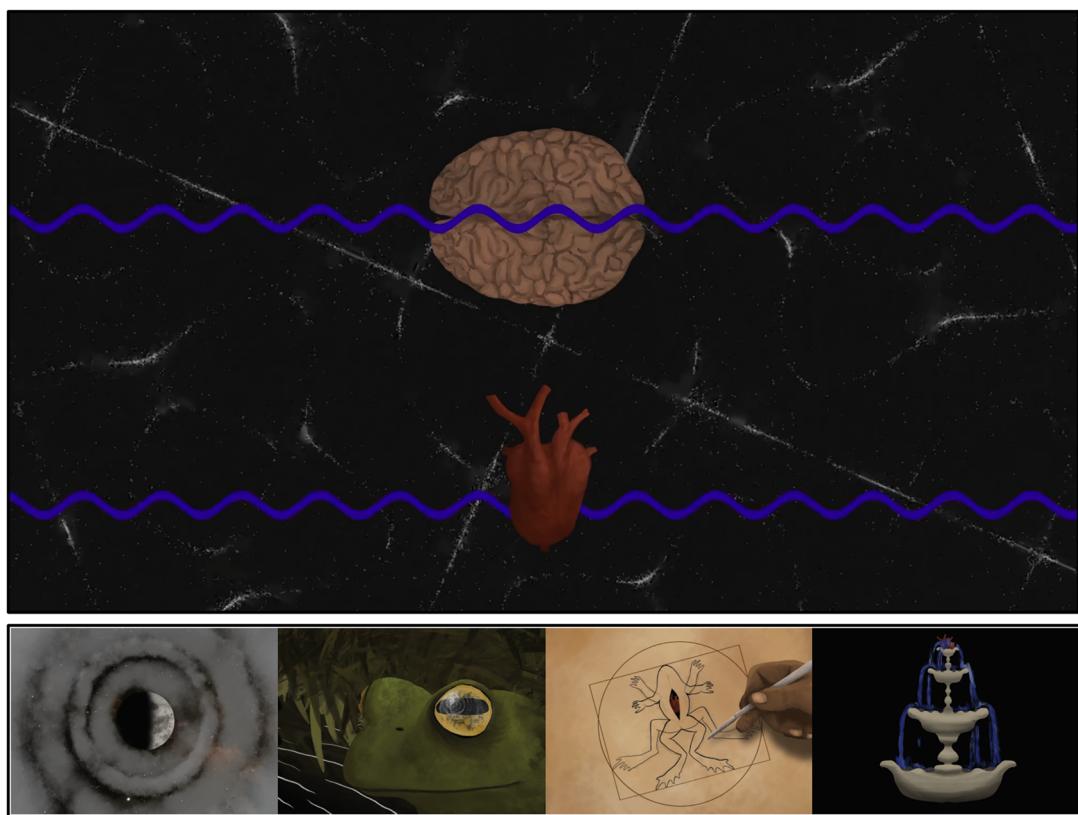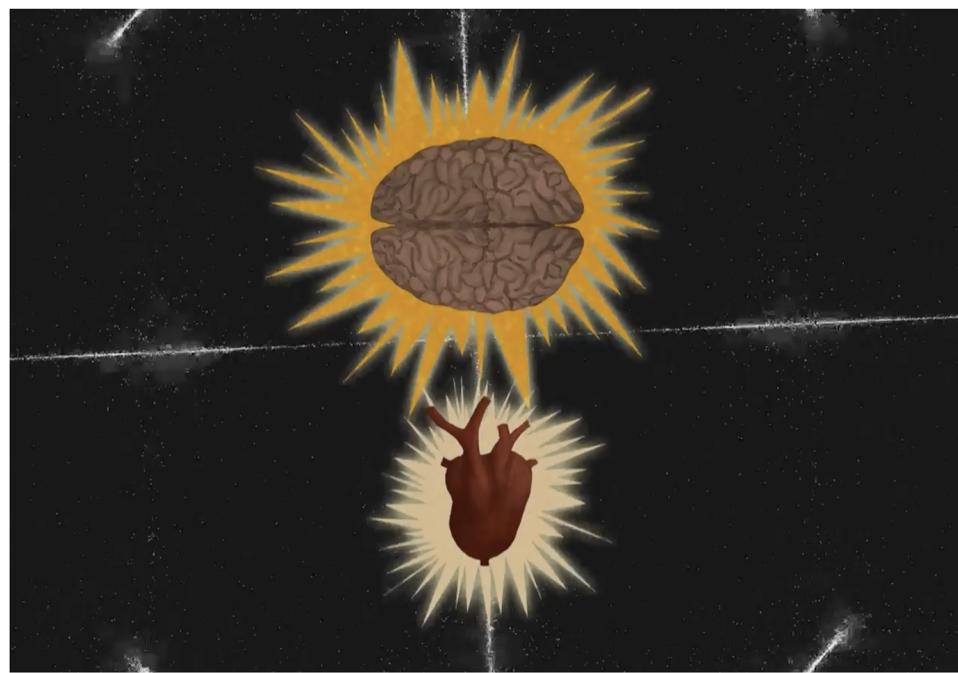
Figure 4. Image stills from "Vagustoff."

Movie 2. Vagustoff: The Brain–Heart Connection. [View online]

souls. And we will gather our compassionate bodies as one, with chimeras of the lands imagining the new shape of our heart."

Ecotones of the mind (Fig. 5, Movie 3) explores symbiotic relationships that exist between humans and the natural world using neuroscientific, mathematical and digital art tools. Our proposal is inspired by the concept of ecotones: regions where distinct biological communities converge, creating a zone rich in biodiversity. The metaphorical interpretation of ecotones extends to the realm of human relationships with nature and other species, challenging traditional views on separation and individuality.
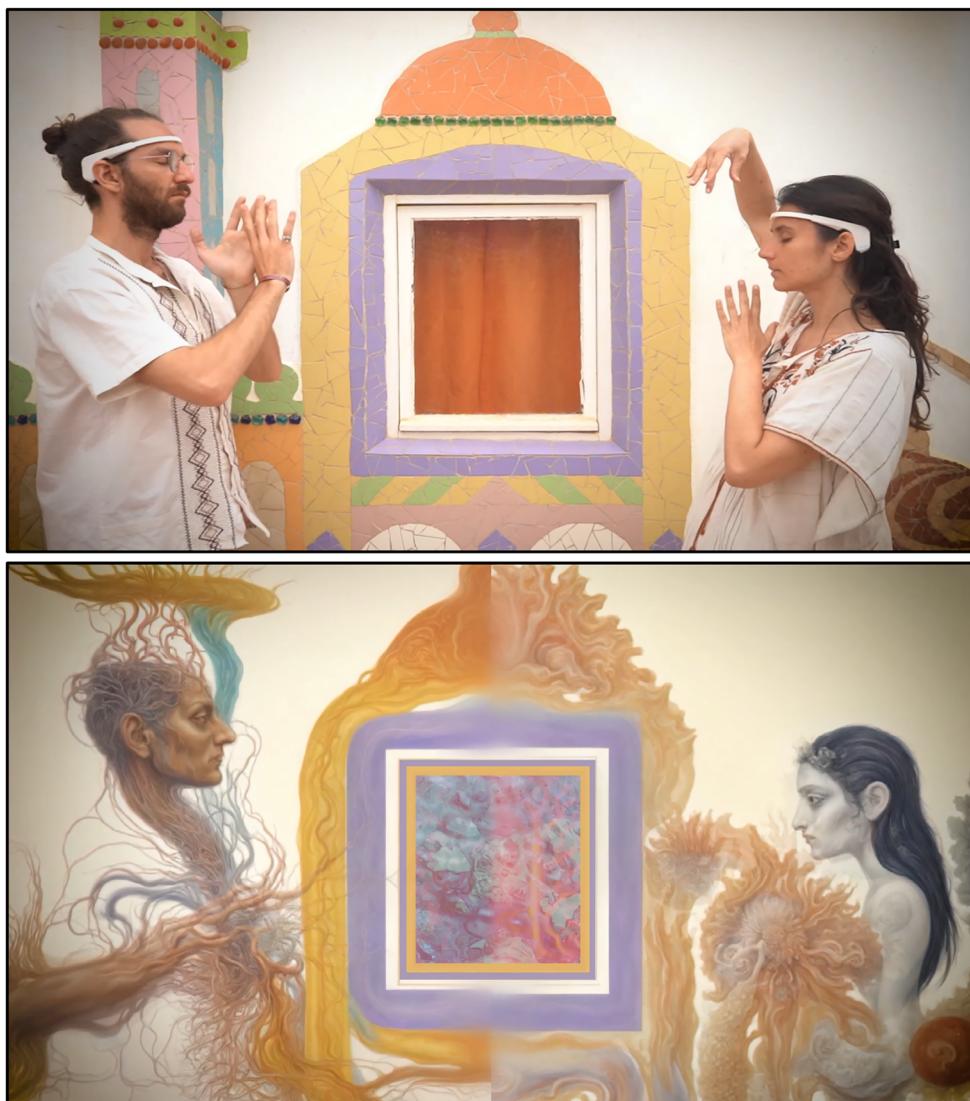
Figure 5. Image stills from "Ecotones of the Mind."

Movie 3. Ecotones of the Mind. [View online]

Figure 6. Inside "No Hammer Needed"—an intimate brainwave monitoring installation—where flickering white strobe lights induce altered states of consciousness.

The artwork is divided into two parts. The first part represents the distinct transformations of two separate human beings, while the second part illustrates how the meeting of their bodies leads to the cocreation of new lifeforms, forming a new ecotone. In the former, the complexity of each person's brain signals was used to guide a generative AI model in transforming their individual representations into abstract structures—systems of roots and corals. In the latter, a measure of brain coupling was used to guide the intensity of the morphing from their original human forms to a collective imagery of chimeric animals. This artistic process mirrors the ecological concept of ecotones, reflecting how individual lives intertwine and influence one another, fostering a biodiverse web of shared experiences and transformations.

Through the lens of ecotones, we are encouraged to reconsider our role within the larger ecological framework, highlighting the importance of community and reciprocity in transcending boundaries. As we observe our representations morph and merge, guided by the invisible link of our neural activities, we witness a digital metaphor for the continuous reshaping of our identities and connections. The beauty of shared creation emerges, a vivid testament to life's complexity and our interconnected existence, ever reshaped by the shifting relationships of our synergistic bodies. The two humans depicted in the video are the co-creators of the artwork (Mar Estarellas, Antoine Bellemare).

Jury Comments: "Ecotones of the Mind reflects on the interconnectedness between humans and nature. The artwork masterfully integrates scientific concepts like brain coupling and ecological principles of symbiosis and diversity, offering a dynamic representation of how individual entities transform through interaction. Its rich metaphorical narrative encourages a deeper consideration of our role in the larger ecological framework, highlighting reciprocity, connection, and the ongoing co-creation of life."

Honorable Mention: No Hammer Needed

Luciana Haill—Independent Artist
lucianahaill.wordpress.com

Artist Description: The seated participant, eyes closed and wearing a black EEG sensor band, transmits their brainwave signals to the artist, acting as a nightclub VJ. Multilayers of real-time neurofeedback visuals blend into vintage postcards, Victorian portraits, and nostalgic local landmarks. The participant experiences an immersive ever-changing display that intertwines memories and minds. The title suggests that light can affect consciousness more subtly and effectively than trepanning, a procedure where a hole is drilled or scraped into the human skull. "No Hammer Needed" (Fig. 6) has been acclaimed as a form of ephemeral portraiture, capturing transient mental states. Haill's digital creations evoke waking dreams, offering a captivating glimpse into the mind's hidden landscapes and blurring the boundaries between reality and imagination. Always merging science and art to reveal the unseen, ephemeral moments that define the human experience.

Jury Comments: "Using live EEG neurofeedback and immersive visual displays, No Hammer Needed captures fleeting mental states and transforms them into ephemeral portraiture. The playful interaction between brainwave activity and nostalgic imagery creates a reflection on the mind's hidden landscapes and blurs the boundaries between reality and imagination. This artwork merges cutting-edge technology with an intimate, personal experience, evoking scientific curiosity and emotional depth."

AON Again

Once again, we want to extend our congratulations to our winners and honorable mentions. It was our privilege and pleasure

to host another edition of "Art of Neuroscience". If these works inspired a desire to create art and submit to our competition, please keep up to date with us via the social media channels detailed above or through our website.

References

Koide-Majima N, Nishimoto S, Majima K (2024) Mental image reconstruction from human brain activity: neural decoding of mental imagery via deep neural network-based Bayesian estimation. Neural Netw 170:349–363.

Loewi O (1921) Über humorale übertragbarkeit der herznervenwirkung. Pflugers Arch 189:239–242.

Sargent KS, et al. (2024) Oscillatory coupling between neural and cardiac rhythms. Psychol Sci 35:517–528.

Shen G, Dwivedi K, Majima K, Horikawa T, Kamitani Y (2019) End-to-end deep image reconstruction from human brain activity. Front Comput Neurosci 13:1–11.