Jellyeyes - Symbiosis, Evolution and Vision

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Abstract

Jellyeyes is an augmented reality installation especially created for the viewer based on symbiosis, touch, and biomimicry. Jellyeyes is inspired by narratives from the theories of evolution, and these stories involve the characters of a hunter-diver-tourist and a marine biologist. These narratives are inspired by the personal diving experiences of the writer and residencies in three different science research centers that focus on evolution in relation to symbiosis, marine biology, and neuro-visual systems.

Keywords

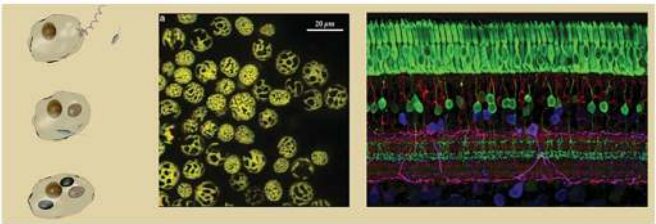
Augmented reality, symbiosis, evolution, eyes, climate change, barrier reefs, empathy.

DOI

10.69564/ISEA2023-27-short-Scott-Jellyeyes

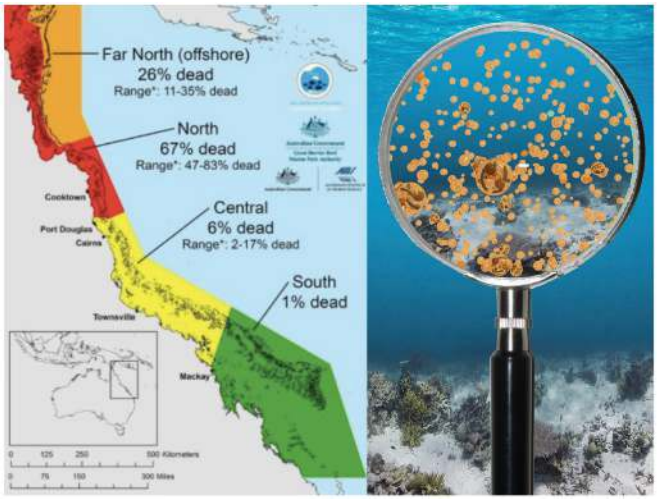
Research

In 1967, Lynn Margulis created the concept of endosymbiosis. In this scientifically renowned theory, she claimed that bacteria was the agent of change.[1] Specifically symbiotic bacteria invaded the primary cells to create mitochondria and chloroplasts, the powerhouse parts of the cell as we know it today. Jellyeyes is about the focus of this theory on the evolution of light cells or fluorescent chloroplasts. They are found in fluorescent bacteria that live in the symbiont algae or Zooxanthellae inside any coral reef. These bacteria called Cyanobacterial Endosymbiont evolved to create fluorescent light that acts as a sun block for the coral and is sensitive to temperature change. These chloroplasts are also found in the pigmented cells of our eyes called Rhodopsin, that move through the photoreceptors of our retinas in reaction to incoming light. (Figure 1)



1. Theory of Endosymbiosis, Zooxanthellae Coral Symbionts and Rhodopsin (photoreceptor pigment). ©Jill Scott

This research in evolution and symbiosis led to discussions at conferences with marine biologists in Australia.[2] In the Great Barrier Reef, symbiotic relationships between fluorescent algae and modern corals are currently being affected by human impacts on the lives of species in this environment. In fact, the health of these symbiotic relationships between the algae and corals, can shift the very roles they play in aquatic ecosystems, for example, as helpers or guardians against pathogens or enemies. The death of symbiont algae can be seen in the latest sad map about coral bleaching in Australia. (Figure 2) Unfortunately, a warmer climate not only affects chloroplasts in algae but symbiont levels of co-habitation as well as some species levels of visual acuity.

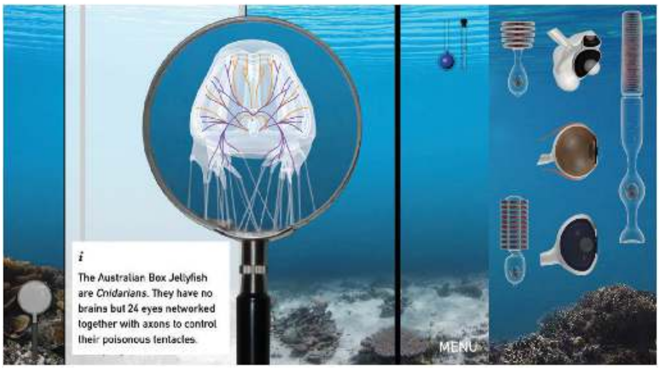


2. Barrier Reef Map and the symbionts. Zooxanthellae Algae. ©Jill Scott

Neuroscientists study the effects of excess light on photoreceptors, and their pigmented chloroplasts.[3] Human photoreceptors have evolved through adaptation and are very similar to the retinas of the box jellyfish and the squid. Classified in evolution under the label of camera-based eyes, all three species share two jelly-like substances; aqueous humor or the moving fluid in the eye that is affected by temperature and vitreous humor: the jellylike shapes with fibers that are attached to their retinas. Hence the title: Jellyeyes!

3. The whole setup of Jellyeyes with 8 photographic panels and Augmented Reality interface on an iPad. ©Jill Scott

Because liquids in these eyes are affected by UV exposure, an increase in bad conditions cause cellular damage and very dry eye problems.[3] Photoreceptors need healthy chloroplasts to function accurately. In humans they control low and high light levels and the photoreceptors are formed from neural tissues and directly attached to the brain (optic nerve). In squid: they control low light levels in photoreceptors that are also attached to their brains, but in jellyfish, they use basic pigmented cells to assess light and these are attached to each other by fibrous tissues. This last species has no brain but what is called a distributed brain. (Figure 4) But how can such information on evolution in neurocience, marine biology and symbiont behaviour be interpreted in an artwork? Could Augmented Reality and biomimicry help us "see" and understand the reef environment through the light receptors of the eyes of other species?



4. Eyes of the Australian Box Jellyfish and photoreceptors of the Squid and the Human. ©Jill Scott

Artwork

In summary, Jellyeyes is such an augmented reality investigation. It consists of a large photograph of a dead barrier reef and an iPad built into a sculpture of the human optic nerve. (Figure 3) The image on the iPad brings the photo alive! Sounds of water and bubbles immerse the viewer into the environment. The aim is to explore the delicate balance of this aquatic ecosystem through the 24 eyes of the box jellyfish, our own human eyes and eyes of squid or calamari. But the viewer can choose a temperature gauge to warm the water, and this changes the environmental conditions! Ocean warming affects the predator-prey relationship of these species and the symbionts algae leave the coral to die. The viewer can select the magnifying glass to discover how the loss of this symbiont caused a loss of a food for the coral to eat, a weakened immune system, bleaching, disease, and death. Warming also creates other food-algae and more jellyfish breed in the reef. In another scenario they can choose to have an empathetic and parabolic look through the eyes of the Australian box jellyfish at the changing predator-prey relationships of species in the reef. The viewer can choose the black and white view of the squid's eye to discover stories about the human hunter or they can use the human eye to see different narratives.

The whole artwork is also available on an iPhone with a downloadable screen-based photograph. Here the aim is to help tourists understand the ecology and the climate change problems on the reef.

But how exactly are these narratives chosen by the viewers?

Evolution and Roleplaying

In Jellyeyes, these narratives are divided into three sections or menus that the viewer can explore: Co-Evolution, Structural Evolution and Comparative Evolution.

Co-Evolution: Here bacteria are seen as the agents of change.[4] In this tribute to Lynn Margulis, Jennifer Margulis (her daughter) is turned into the character of a marine biologist, who collects evidence about the state of symbiont death in the coral and refers to her mother's theories. She collects fluorescent bacteria from the algae (zooxanthellae) and measures the corals level of nutrition and growth, how they block excessive sunlight, control toxic compounds, stress levels and even ward off pathogens who attack the algae. The viewer's interaction causes acidity and symbiotic destruction in this environment. (Figure 5)

Structural Evolution: This menu takes Charles Darwin's theory of adaptation[5] and applies it to the camera-based eye. How has this eye evolved in relation to its lineal ancestors. The result is a simplified tree of the evolution of visual perception. (Figure 8) For example, the jellyfish is an early example of our eye's development and the squid another stage in the evolution of the light receptors of the camera-based eye. In this narrative, an ignorant, destructive tourist steals too much food. Sometimes, even digs into the coral to the horror of the scientist who tries to teach respect for this environment. (Figure 7)

Comparative Evolution: James Lovelock once said that life has created the conditions for its own existence.[6] In this menu, the viewer can choose either the eye of the box jellyfish, the squid, or their own eye to see the relationship between the behavior of these three species in the barrier reef environment. The ignorant diver tourist plays around with the poisonous Australian box jellyfish and every day more of these very stingers swim in the reef. Ocean warming shifts the ecology of the reef's predator-prey relations and behaviors like these will have a backlash and harm our own existence. (Figure 7)

As in previous artworks,[7] Jellyeyes uses the sensorial strategies of touch and biomimicry, to create performative roleplaying to augment the above narratives and their repercussions. In Co-Evolution the role of the participant becomes the CO2 emitter and through touch he or she or they, learn about the reactions of symbiont bacteria, the survival of the coral, depreciation of the symbiont algae, squid, and reproduction of the box jellyfish, as well as the interdependencies between these species. In Structural Evolution, the participant becomes the investigator and learns through touch about the similarities of vision between species and about the evolution and health of the light receptors in the photoreceptors. In Comparative Evolution, the viewer becomes an empathizer, they see through the eyes of these species and can change these views with touch to identify what they see. Here, the biomimicry of sight is used to witness the human environmental impacts on the reef itself.

5. Co-Evolution: Scientist collecting symbiont samples from Alge on the Barrier Reef. ©Jill Scott

6. Structural Evolution: The black and white parabolic view from the eyes of the jellyfish and the menu to choose different eyes. ©Jill Scott

7. Comparative Evolution: The hunter tourist interacts with the jellyfish and the scientist. ©Jill Scott

Conclusion

Perhaps, augmented reality art might be an effective catalyst for climate activism and education. Here the aims are to reveal the influence of evolution on species survival in relation to the health of their habitats, to the need for inherited variations and to the mutual benefits of keeping symbiosis alive. It is dangerous for us and them not to mitigate climate change. Jellyeyes clearly shows the effects of our fossil fuel emissions on the survival of the species in the reef. It offers a novel creative interpretation of structural evolution and ecological interconnections. Here, the viewer becomes immersed in the symbiotic sensory relationship between algae, vision and modern corals. Viewers say that Jellyeyes encouraged them to think about variations and reproduction problems as well as symbiotic mutualism. They empathized with non-humans by “seeing” through the eyes of other species. Afterall, the future of the barrier reef on this planet is in the eyes of many species, but it is now in our hands!

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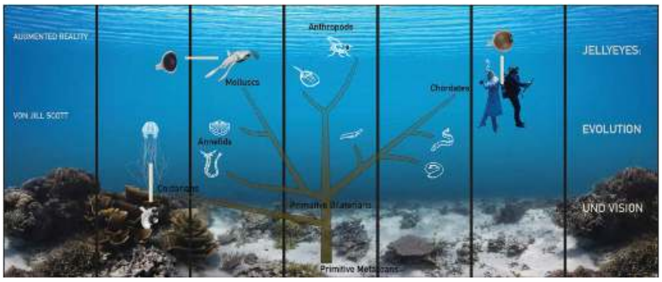

8. The Evolutionary tree of the.Camera Based Eye. ©Jill

Figure 9. A viewer meets the Marine Biologist. ©Jill Scott

10. The AR interface case based on the Human Optic Nerve. ©Jill Scott

Partners

HFF, The Munich Film Academy. Munich, Germany
Dr. Lisa-Ann Girshwin (CSIRO Australian Marine Stinger Advisory Services, Australia)

Scientific Consultants

Prof. Dr. Stephan Neuhauss (Institute for Molecular and Cellular Research, Neurobiology, University of Zurich, Switzerland) Prof. Christopher Robinson (Aquatic Research EAWAG, ETHZ, Switzerland)

Funding

Pro Helvetia, The Swiss Arts Council
HFF, The Munich Film Academy. Munich, Germany

Production Credits

Concept & Directing: Jill Scott Production: Marille Hahne Camera: Julia Daschner
Light: Georg Nikolaus Animation: Natascha Jankovski
Postproduction: Moritz Huber Programming: Nikolaus Völzow

Biography

Jill Scott is a media artist, a writer and art and science researcher. She is professor emerita at the Zurich University of the Arts (ZHdK) in Zürich and founded their Artists-in-Labs Program in 2000. Her own artwork spans 44 years of production about the human body and body politics. In the last 20 years she has focused human health based on research into molecular biology, neuroscience, and ecology. She has had many international exhibitions in both art and science venues. She also directs LASER Salon in Zurich for the Leonardo Society USA and writes books on art and science (Springer and de Gruyter).

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