ECHO OF THE ABYSS: UNDERSTANDING MORE-THAN-HUMAN INTERCONNECTEDNESS IN THE DEEP SEA THROUGH VIRTUAL REALITY EXPERIENCES.

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ABSTRACT

This pictorial presents Echo of the Abyss (EotA), a Virtual Reality (VR) experience that immerses users in a simulated deep-sea dive. EotA aims to foster a sense of connection and curiosity towards marine ecosystems by allowing players to embody a diver, guided by aquatic animals, in a safe and contemplative virtual environment. The design leverages theories from HCI, ecopsychology, and hydrocommons to promote environmental stewardship and emotional engagement with the ocean. EotA's narrative and interaction strategies are intended to overcome barriers to accessing blue spaces, providing transformative experiences that nurture empathy and ecological consciousness. Early pilot studies confirm that EotA aesthetic feel, interaction design and game mechanics can enhance human connection with remote ecosystems; further studies will investigate the long-term impact of VR experiences in Ocean conservation.

TEI '25, March 4–7, 2025, Bordeaux / Talence, France

ACM ISBN 979-8-4007-1197-8/25/03.
https://doi.org/10.1145/3689050.3704432

Authors Keywords

Ecopsychology; More-than-human; Digital Games, Interactive storytelling; Virtual Reality

CSS Concepts

• Human-centered computing~Virtual reality
• Human-computer interaction (HCI), Interaction Design

Figure 1. Echo of the Abyss key visual.

INTRODUCTION

With more people having set foot on the moon than in the deepest parts of the oceans, the deep sea is still a largely unexplored and alien environment. The potential benefits of experiencing the deep sea through virtual reality (VR) offer a promising area for design research. Embodied experiences of the seas given by water immersion, such as freediving, swimming or surfing, can be healing from a physical and mental health perspective [29, 39]. They can also potentially foster the kinship needed to heal the relationship between humans and thalassic more-than-human. Our relationship with water bodies can shape our identities and sense of belonging and influence our physical, emotional, and spiritual well-being [6, 21, 23, 30, 36, 41, 42]. This research intersects HCI, ecopsychology, and hydrocommons, focusing on the role of Virtual Reality (VR) in enhancing the human connection with water bodies. It draws from the growing interest in "blue spaces" [12] and their impact on human well-being (individually, socially, and ecologically), as a way to critically address the division between nature and culture.

Problem Statement

Despite the recognised benefits of interacting with blue spaces, there are barriers to accessing these environments, including geographical, physical, and psychological limitations. Such barriers include urbanisation, privatisation and pollution of coastal areas, physical distance or inability to travel, and physical and psychological barriers like motor impairments or thalassophobia. Communicating complex phenomena such as human impact on ecosystems and climate change-related topics can be complex [7, 8, 16], especially when considering ecosystems far from the audience's reach, such as the deep sea [7, 16]. For instance, Huntley argues that geographical distance can cause emotional distance with far away natural places impacted by climate change and human activities [16]. This physical and emotional distance can cause feelings of detachment towards wild natural environments. Desensitisation towards the more-than-human and considering nature as "other" rather than seeing human bodies in correlation with it can deepen this gap [2]. Addressing this gap is crucial for promoting holistic well-being and deepening ecological consciousness, as identified in interdisciplinary studies on blue spaces [29, 30, 43]. Projects like Sensing Bodies bridge the distance between human and more-than-human bodies, investigating the ambiguity and sensitivity of multi-species relationships, "highlighting geographic and cultural situatedness" through biosensors [34]. Silk et al. highlight the importance of "nature on screens", such as on social media, video games, and VR and their media reach [35]. VR's immersive nature can effectively simulate the restorative and therapeutic effects of blue spaces, which have significantly benefited mental and physical health while contributing to the vital role of promoting environmental stewardship [17, 22, 24, 31, 40].

VR technology transcends physical and geographical barriers, making experiences with blue spaces accessible to a broader audience. This accessibility is crucial in fostering a deeper understanding and appreciation of marine environments. Webber's analysis demonstrates how HCI research enables technologies to promote experiences in nature, even in those natural locations that are distant to users [42]. Water immersion studies and projects like Fluito [27] and Project Shell [31] demonstrate how XR technologies can increasingly offer digital experiences of nature that can help nurture empathy towards the more-than-human in hard-to-reach blue spaces.

Figure 2-3. Freedivers. First Author's archive

Objectives, Hypotheses and Contribution and Novelty

This pictorial introduces Echo of the Abyss (EotA), a novel VR playable experience that immerses users in the deep sea. EotA offers a meditative experience where players embody a diver descending into the deep ocean. Guided by marine animals, players are encouraged to feel awe, comfort, safety, and relaxation. The experience includes a series of healing-themed challenges that lead to a transformation, both physical and internal, fostering a sense of interconnectedness with the marine environment.

This work contributes to tangible, embedded and embodied interaction by exploring how VR can enhance feelings of connection with distant blue spaces like the deep sea. In this pictorial, we detail the design strategies for the EotA experience, aiming to create deep and positive connections with the ocean and its ecosystems. Our approach uses Research through Design, incorporating interaction and storytelling strategies into the prototype. In particular, this pictorial outlines the design process of EotA and preliminary user observations, generating a discussion on constructs for the design of VR diving experiences. These constructs then provide the basis for future empirical research with this artefact.

THEORETICAL FRAMING AND RELATED WORK

Departing from the classic doom-and-gloom rhetorics of mainstream media [10], we were inspired by the following set of theories.

Decentering the human in design

Engaging audiences by sparking their curiosity and connecting them to remote ecosystems is crucial in climate change discourse [26]. The goal is to encourage people to actively steward and protect these ecosystems, as this can motivate them to take action. This approach builds on Escobar's propositions [9], which position humans not as the central focus but as integral components of a balanced system maintained by the connections between its parts. Bortoft and Kossoff treat natural systems as organisms and argue that they are made of interconnected parts that function together in an interdependent way [5, 18]. Donna Haraway talks about sympoiesis as a way for parts to relate. She states that beings exist in a correlation between each other and evolve "with" each other. It opposes the concept of autopoiesis, in which a system can produce and maintain itself by creating its parts [15]. With these theories, HCI embraces Tsing's "Art of noticing" [38] through several adaptations. Biggs et al. propose "noticing" as an innovative methodology for decentering humans in design through birdwatching and journaling [3], where tuning in with nature happens through a deep listening mode of attention. In this work, the action of decentering isn't focused on perspective-taking as others but on noticing environmental connections as humans. By nature, VR experiences are user-centric, taking a first-person perspective of who is living them. In EotA, the users experience a deep dive, embodying themselves as divers, while their attention is brought to a perception of connection to the more-than-human underwater. Users are encouraged to think of themselves in relation to the environment through suggested connections with more-than-human others and their own body transformation.

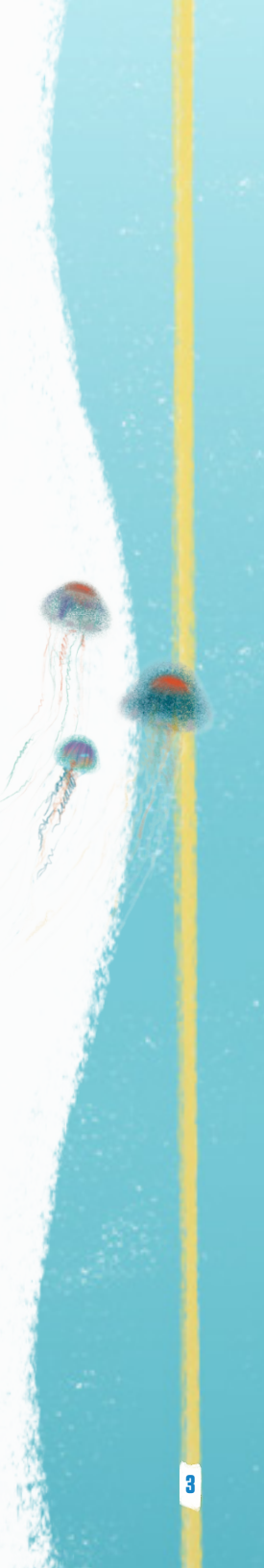
Ecopsychology

EotA is designed according to ecopsychology principles, a transdisciplinary field that places "human psychology into an ecological context", seeking to "mend the division between mind and nature, humans and earth" [43]. In Andy Fisher's words: "Ecopsychology in the recollective sense is about remembering how we belong to the earth, how everything about us came out of the land and our interrelationships with countless other-than-human beings." [11, 43]. In "The Voice of the Earth", Theodore Roszak discusses how the core of the mind is the ecological unconscious, and the aim of the discipline is to help the ecological ego mature towards a sense of ethical responsibility for the planet [33]. Roszak also looks at the role of animism in fostering a connection between the self and the non-human world, stressing the mutual benefits of planetary and personal well-being [33]. Finally, we consider the theory of biophilia, an affective response to nature, as part of ecopsychology. Reez et al. investigated it in the setting of non-violent exploration games, finding users' improved attention when comparing digital natural spaces to urban spaces [32].

EotA incorporates ecopsychology by offering a safe and calming experience of deep sea diving, seen as distant by many [1]. By connecting the abyss experience with calm and reflective actions, we aim to remove that sense of fear and cultivate curiosity and connection with the ecosystem.

Hydrocommons

In EotA, the body transformation metaphor engages with Neimani's concept of hydrocommons, which refers to the water cycle that connects our body to the ecosystem [28]. The water we breathe or drink eventually returns to the biosphere, becoming part of the larger ecosystem as rain, oceans, and living creatures. Hydrocommons dictate a new ethical system in which we become accustomed to unknowability, adapting to a changing landscape, and dealing with new emergencies [28]. Since our bodies are 70% water, can we truly say they belong to us? In EotA, hydrocommons become a tangible physical place to be experienced, felt, shared, and embodied. The concept of hydrocommons in this work brings users' awareness to their body and how it relates to water immersion and the more-than-human in the experience, shifting the focus from the environment to a more intimate bodily reflection expressed through a transformation of the body.



Prior Work

We briefly report on related work that inspired our design, related to understanding how digital-physical interactions can foster awareness, curiosity, and kinship with the aquatic environment [24].

Markowitz and Bailenson's studies on immersive VR applications that facilitate learning about ocean acidification reported participants' interest in the topic and positive knowledge gain. Their study focused on a VR diving field trip in VR and demonstrated how the experience was effective because it was close to many aspects of the real-life experience [25]. Animal companionship in VR games successfully creates empathy with more-than-human actors. Lin discusses how players drawn towards playing VR games with pet animals want to have the experience of having an animal companion when it is not possible in real life [19]. EotA does not represent pets but wild animals, whose relationship to humans must be considered carefully. An embodiment of a wild animal can also foster interconnectedness and curiosity towards oceans. Bordegoni's Colonies VR application invites users to embody bees to convey environmental literacy [4]. Pimentel's work suggests that when people embody an animal in VR, it might change their attitude toward the ocean [27] by connecting animal embodiment with empathy. Yee and Bailenson demonstrate how body-swapping techniques in VR can enhance perspective-taking and compassion towards people [44]. EotA builds on Pimentel when considering the possibility of users embodying the experience as themselves, giving them a sense of human connection - with their own body, transforming during the game, a physical one as much as an intellectual one. Montoya explores the concept of "water as playground" by designing a playful application that uses the human body in a VR setting to amplify the user's experience of a floatation tank while promoting relaxation [27].

EotA addresses the uncertainty users might feel in its digital environment by drawing on the theories of To et al., who suggest that uncertainty can be approached with either curiosity or helplessness [37]. The emotional response to unpredictable situations can significantly impact the experience [37]. EotA's design employs narrative transportation into the loose narrative of a diver's journey and character identification with a diver character to influence and guide players in their deep dive experience [13, 14], maintaining the mysterious nature of the ocean depths while ensuring users feel secure and engaged.

DESIGN OF ECHO OF THE ABYSS

EotA takes the players into a deep ocean dive of around 10 to 20 minutes, depending on the player's speed. Users are encouraged to identify with the character of a diver who embarks on a journey into the deep sea. Rather than being narrated by a human, the story is guided by wild animals that users encounter closely during the dive. These animals lead users deeper into the ocean, inviting them to explore and discover the surrounding environment. EotA offers an immersive experience, inviting users to contemplate and engage with the marine world and its inhabitants. The player "swims" into the space by using the device's controllers, mimicking a natural swimming motion, "treading water" using a back-and-forth motion of their extended arms, which bends at the end of the movement to return to the starting position along the body. Users are meant to perform this movement while standing up, as it involves most of the upper body.

EotA conveys a sense of interconnectedness and curiosity toward the seas by giving players the experience of a dive and a closeness to different species that wouldn't be possible in real life: a seal, a whale, a giant squid, a coral, and a jellyfish. While some of these animals are common in a dive, some live in specific locations, and even when reaching these locations, there's no guarantee of any interactions with humans. In particular, the giant squid has only been seen alive a handful of times, since it lives in the abyss, thousands of meters under the surface, a place hardly reachable by humans and still underexplored. Real-life scuba and freedives don't encourage getting too close to wild animals for ethical and safety reasons. EotA doesn't want to encourage this either, but it wants to give users the chance to get nearer, observe, and feel a connection, involving them in this alien environment.

To design a VR experience that prompts interconnectedness and curiosity with the seas, we developed a series of design constructs that we grouped into two macro areas:

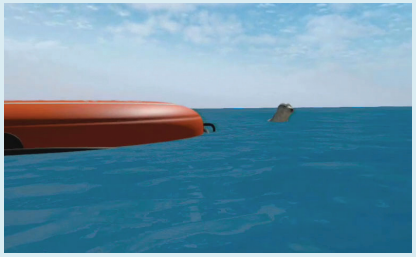
1st DESIGN CONSTRUCT

PROVIDING A SENSATION OF SAFETY

2nd DESIGN CONSTRUCT

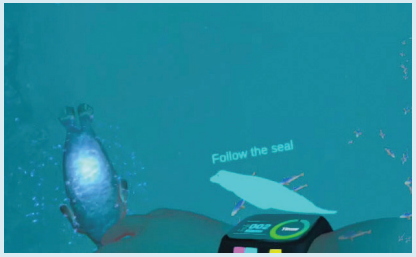
CONSIDERING THE HUMAN BODY IN THE OCEAN CONTEXT

ECHO OF THE ABYSS STORYBOARD. The story of EotA through screenshots of the experience.



1. The experience starts with the player, embodying a diver, floating on the open ocean's surface next to a boat, having a buoy and a seal.

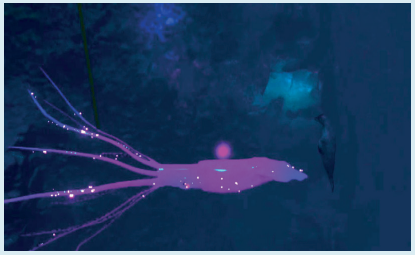
2. When the user gets near the seal underwater for the first time, the seal will blow bubble rings toward the player's face, indicating the start of a special connection.



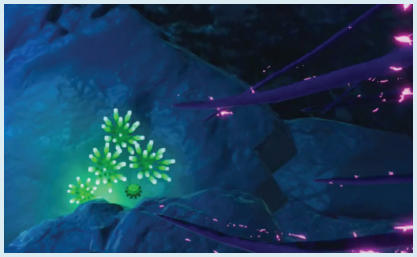
3. The seal starts diving deeper, and the diver is prompted to follow them underwater through notifications on the dive watch.

4. The water starts getting darker mid-depth when they meet a whale.

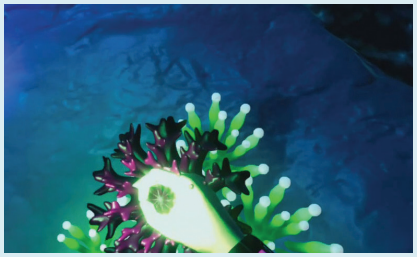
5. A notification on the dive watch encourages the diver to help the whale by removing a piece of metal stuck in its tail. Notifications, glows, and the seal's gaze help the player know what to do.



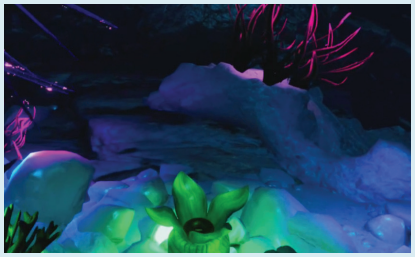
6. After the metal is removed, the whale swims away, and the diver is encouraged to follow a giant squid to the bottom of the ocean.



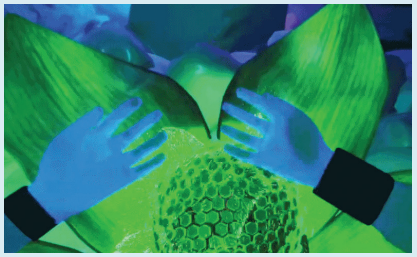
7. A coral detached from its habitat is bleaching. It needs help. The squid points at the coral for the user to find it, helped by a pulsating sound and a notification from the diver's watch.



8. The player is prompted to hold the bleached coral carefully.

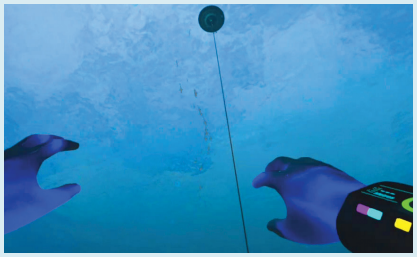


9. The divers place the broken coral into its original ecosystem, represented as a sort of marine flower: the anemone. Again, notifications and the squid's behaviour serve as visual cues for the player on what to do next.



10. This action "heals" the coral and triggers a fantastic"explosion" of bioluminescence all around the player, eventually reaching the diver's hands.

11. At this point, the hands transform, turning blue, slightly transparent, with a fluid look. The player is also notified they unlocked a "swim boost" to swim back to the surface faster.



12. The ending music, to the beat of pulsating dancing jellyfish, leads them to swim faster and faster towards the surface, where the dive and the VR experience end.

1st DESIGN CONSTRUCT

SENSATION OF SAFETY: THE ROPE

The deep sea can invoke feelings of fear. To keep players in a state of relaxation and enjoyment, it was necessary to tone the fear down in favour of a sensation of safety throughout the experience. EotA's design uses two artefacts: a rope and a buddy. Similarly to a freediving session, the rope is attached to a floating buoy. It enhances the user's spatial awareness by guiding the player to navigate the space and swim in the right direction without getting disoriented.

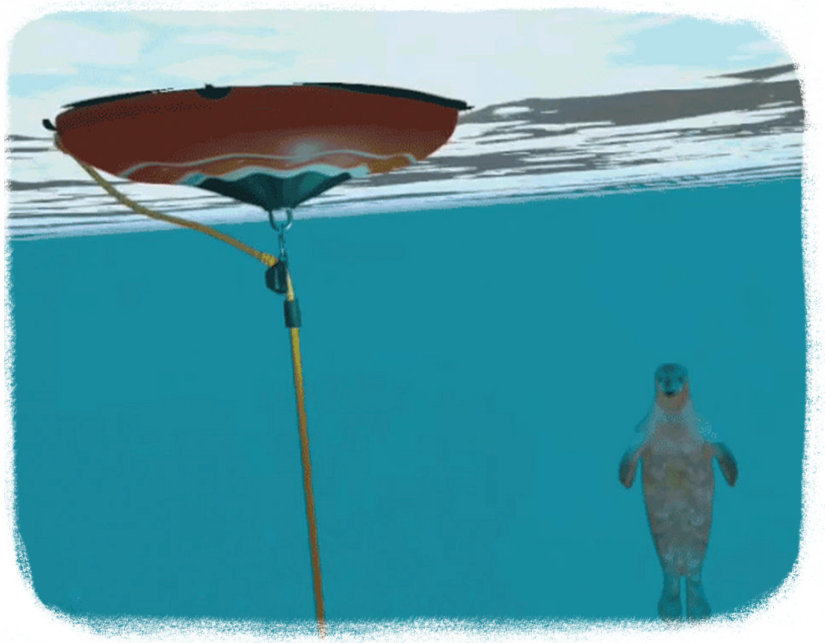


Figure 4. A screen capture of how the rope looks like in the experience.

Figure 5. An initial illustration of how the rope looks in relation to the environment design.

1st DESIGN CONSTRUCT

SENSATION OF SAFETY: THE BUDDY & ANIMAL GUIDES

One of the first diving rules is never to dive alone. Having a trustworthy guardian makes real-life divers feel safe and relaxed during their dive. EotA transposes this feeling of "being looked after" into its digital setting by iterating a few different designs, from having a probe buddy following the experience to having a voice-only buddy talking to the player during their descent.

Eventually, the idea was dropped in favour of a more-than-human marine companion to accompany the player to the depths of the seas. Since the experience already included close encounters with wild animals, this feature could also serve as a way for players to bond with them, offering them opportunities to notice the animals and reflect on their interdependence. While gamified and abstracted from reality, our prototype still accounted for some realistic biological capabilities of the animals. As much as it is possible in the abstraction of a 3D graphics environment, anthropomorphisation was avoided. For example, the first encounter starts on the surface with a seal. Our intention was to draw from its real-life propensity to playfulness, to invite users into the alienness of the depth gradually while also realistically representing the seal as an animal that lives near the surface of the ocean. As the player goes deeper into the oceanic environment, new companions appear, departing from human resemblances (e.g. the human-like eyes features of the seal) and tuning into creatures of the deep, with fewer connections to human traits. We used the capabilities of the VR medium to take users into a playful and hyper-realistic experience, mimicking the seal's natural behaviours, gamifying it in the moment it points at the second animal guide: the whale, with its known connotation of environmental conservation. Subsequently, players are prompted to follow the alien-looking squid, which can only survive in the depths. Finally, the player encounters and interacts with an inanimate form of life, such as a coral marine species. At the end, the player follows impalpable, bioluminescent jellyfish that accompany them back to the surface. EotA is designed to invite the player to gradually trust the oceans, making kin with increasingly otherworldly ocean creatures.

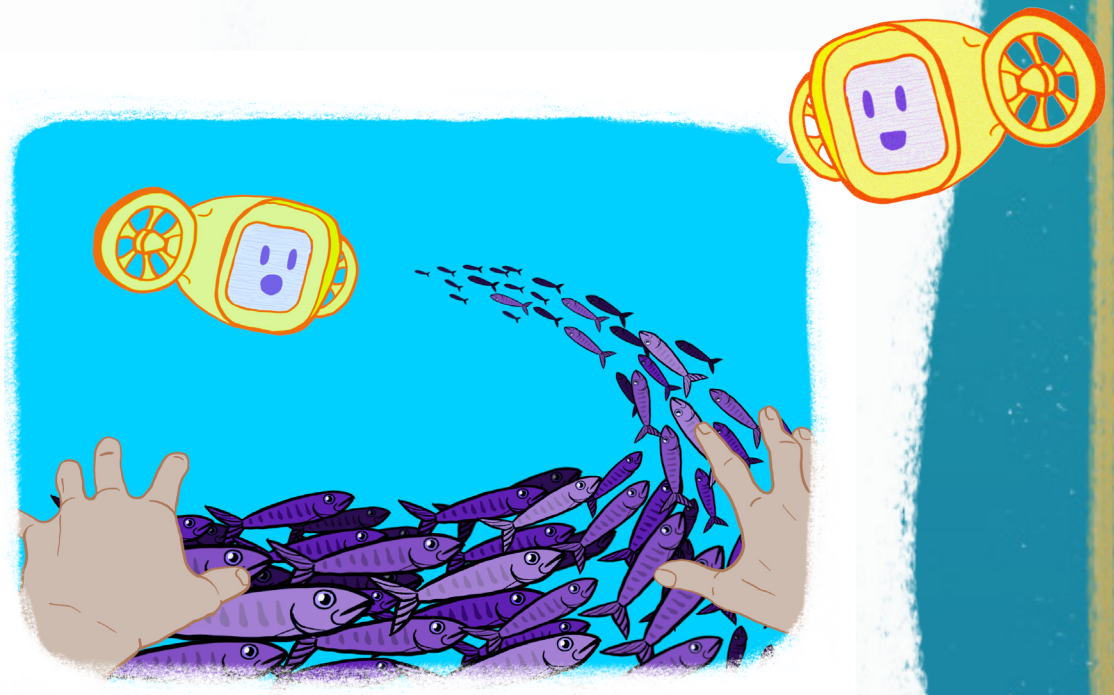
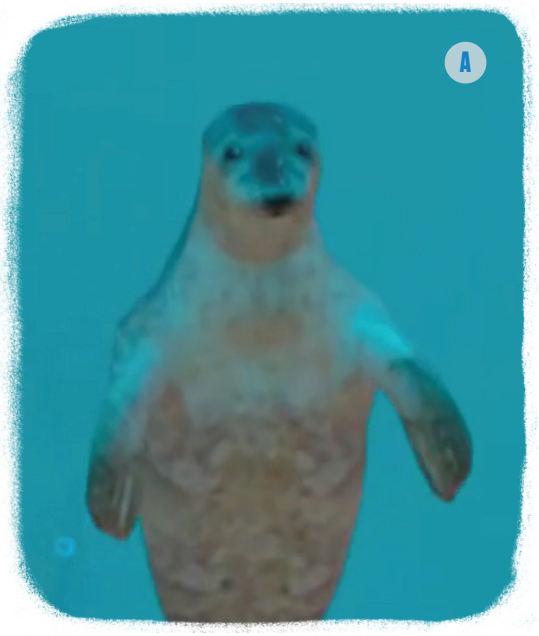
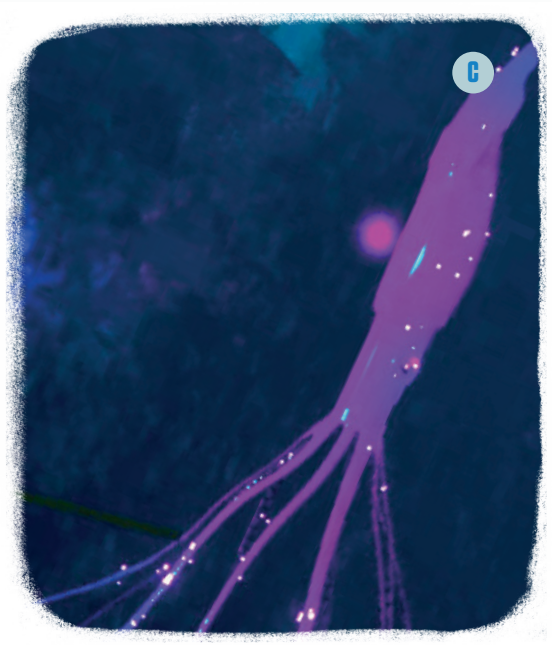


Figure 6. Illustration of one of the ideas for providing players with a robotic buddy.





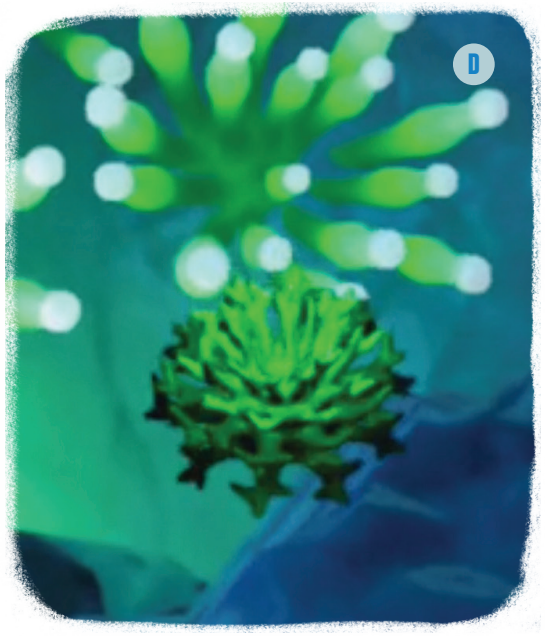


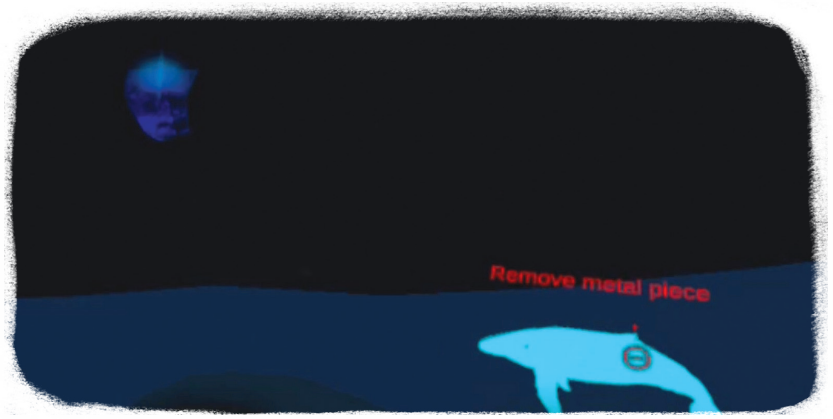
Figure 7. Animal companions represented in EotA. Users are guided first by a seal (A), a marine mammal that can feel familiar to most. They then have a close encounter with a whale (B) in darker waters to give space to more alien-looking creatures like the squid (C), coral (D), and jellyfish (E), whose bodies are very different from ours, making it harder for humans to empathise with. The aim here is to get users gradually accustomed to this "alien" under-understood world and give them a feeling of awe and familiarity that we hope will prompt more feelings of curiosity and interconnectedness.

2nd DESIGN CONSTRUCT

HUMAN BODY IN THE OCEAN CONTEXT: CHALLENGES

A second set of design choices focused on designing and managing the player's body and its transformation. EotA was conceived around a few challenges related to environmental healing. The players' purpose was to connect with the environment by acting as ecological guardians and agents of the environmental transformation around them. A notifications system was integrated through a smartwatch that helps users interact with the challenges.

Figure 8. Screen capture of the notifications system through the smartwatch. We tested a few methods to give users a buddy that could make them feel "looked after", like in a real dive. While we opted for the animals to play that role, we also didn't want to cartoonise wild animals and have them communicate with the users in human ways. We wanted users to be able to observe the behaviour of animals to find cues on what to do next, but we found that for non-expert gamers, it was necessary to aid that with a notification system; hence, we decided to implement a dive watch for that purpose, since it's a device already used by default in activities like scuba and freediving.



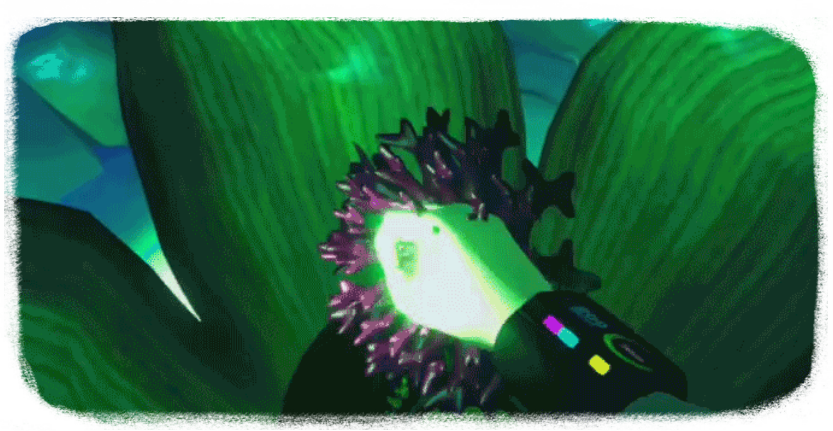


Figure 9-10. Screen captures of two challenges. The user has to remove a metal piece that is hurting the whale and "heal" a bleached coral. Both challenges revolve around the theme of healing, with the aim of making the users feel like they have a positive role in and impact on the environment they're visiting.

2nd DESIGN CONSTRUCT

HUMAN BODY IN THE OCEAN CONTEXT: BODY TRANSFORMATION

To bring awareness to the player's acquired kinship with the ocean, at the end of the experience, the player's body, made of dense flesh, transforms into a marine, watery, more-than-human creature. From initial ideas of players' bodies gradually transforming into "water" and merging with the oceans as they dive deeper into it, the transformation eventually focuses on one pivotal moment when the player, after helping several marine creatures, is at the bottom of the sea, about to ascend. Visual cues, such as light particle animation, and tactile cues, like haptics on the controllers, were used to bring the user's attention to the hands- the only part of their human body visible to the player. The first author composed music for this scene to transport the user into a dreamy ascent and the end of the game and to support the player's perception of their faster swimming abilities as they head to the surface. The avatar transformation provides a metaphor for a change of perception. We wanted to transpose the sensation of a real diver undergoing a transformation into a feeling of belonging to the aquatic ecosystem by moving differently than on land, more "fish-like".

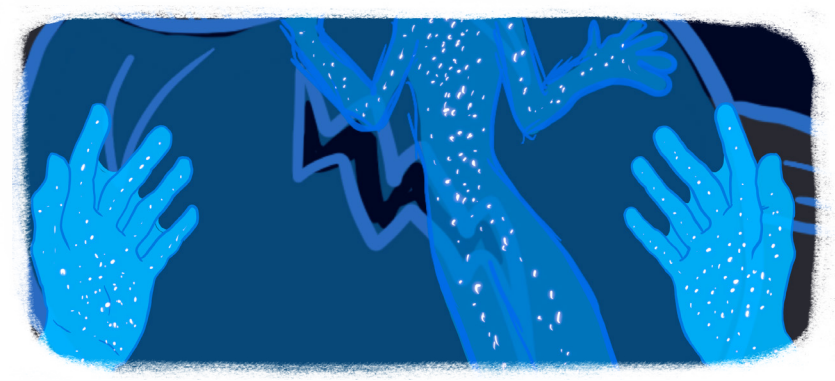


Figure 11. The initial idea of using reflective surfaces to show the body transformation.

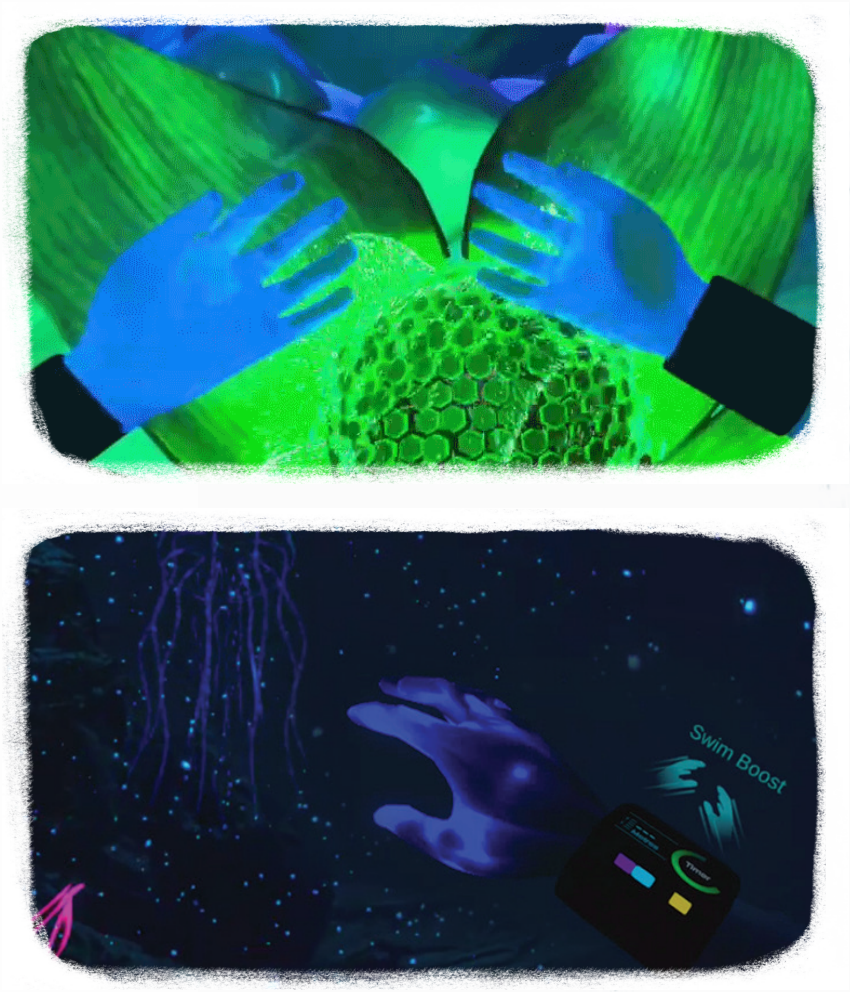


Figure 12-13. Body transformation and how it looks in the experience. The body transformation aims to make the player feel like they are becoming more-than-human by taking part in this dive. In real-life dives, the human body has to move differently than on land, augmenting the body by wearing props (wetsuits and fins) and imitating other animals' swimming. The team wanted this transformation to be felt in EotA by augmenting the human body to "become water" to make users swim more comfortably and feel a sense of belonging, a part of the ocean. The hands change visually, from skin colour to a blue animation, and a "swim boost" is implemented, making the player more agile in the water.

DESIGN VALIDATION

To pilot the experience and validate our design choices in EotA, we conducted preliminary testing and iterated the prototype design to fine-tune the user experience. We've conducted three iterations of the design, testing with 10 participants in total, moving from low-fi to high-fidelity prototypes. Results from the initial pilots foregrounded several prototype refinements and two directions for further studies, which are the subject of forthcoming publications.

First prototype piloting

Eota was first piloted with two interaction design experts and two HCI researchers. They tried the experience at their own pace and exchanged impressions with the first author at the end of the session.

Results highlighted: i) The swimming motion was awkward and tiring, inducing some discomfort and frustration; ii) The animals and the environment induced a sensation of awe but also distracted from the challenge of reaching the bottom of the sea; iii) Participants appreciated the guiding presence of the rope; iv) The information delivered through the dive watch was too fast. We improved the prototype by adding a tutorial to explain and ease learning about the VR swimming movement and made the notifications on the dive watch last longer. Improving the learning of the swimming action in VR is not only a user experience problem but a design challenge about improving embodiment. Using the body to move in VR in a way that is truthful to the experience of swimming in the water was fundamental to putting the users in a position of character identification.

Second prototype piloting

The second version of the prototype was tested with one VR expert and one swimmer: i) The swimming experience, although not perfect, was improved; ii) Users were still confused about the goal of the experience; iii) Users were more receptive to notifications, which suggests the change of timing helped them in the navigation; iv) Users struggled to notice the body transformation. These considerations call for more guidance during the experience. To provide that, we added an onboarding video, which helped users understand the goals of the experience and highlighted the body transformation at the end of it through light particle animation and haptic effects (vibration of the player's handheld remote). We added the music and fast-swimming features further to enhance the joyous sensation of the body change.

Third prototype piloting

We pilot-tested this third prototype with users that had a wide variety of experiences with the sea - two freedivers and two non-divers: i) Both groups struggled to recognise the visual design (hands becoming transparent like water) as a body transformation. ii) However, we noted that most freedivers, being accustomed to water pressure, were mimicking a real dive experience, including equalising their ears or trying to hold their breath. This suggests that this VR experience could convey body transformation more effectively through embodiment and physical movement rather than relying too heavily on visual cues; iii) The freediving group found it harder to adapt to a different, less technical kind of swimming; iv) The non-divers group found the act of swimming more natural and had less struggle adapting to it. They were less accustomed to the aquatic environment, making them more prone to getting nearer to the animals and following them. Both groups expressed deep curiosity about the animals in the experience, showing promising results for our primary objective of designing an experience that emotionally connects users to the deep sea.

DISCUSSION

In this paper, we have illustrated the design of EotA, a playable embodied VR experience of a dive into the deep sea. The experience's objective was to induce curiosity towards the sea and a feeling of interconnectedness with its ecosystem. We are building on Holmes et al.'s theory about meeting uncertainty with curiosity by using narrative transportation and character identification to influence players' in-game experiences, balancing the alienness of the deep seas with a sense of safety that counteracts helplessness. Animal companions and a diver's watch as a tech buddy to inform and reassure the divers in their experience of the Abyss [34] proved to be a positive game design choice. Moreover, by positioning the player as a diver (character identification), the user is challenged with ocean "healing" practices as micro-narrative elements during the gameplay (healing the whale by extracting a piece of metal from its body and healing the bleached coral by repositioning it its nourishing environment). By taming real-life elements of fear associated with the deep sea (e.g. low visibility, dangerous waves or currents, or scary animals) and adding healing themes to the narration, EotA empowers users and prompts their curiosity towards these under-researched and yet exploited ecosystems. We expanded on Montoya's "water as playground" by adding playfulness as a quality of the animal companions' interactions with the humans (the seal blowing bubbles in the player's face) and the aesthetic design of the experience at the bottom of the sea. These design choices resonated with our users, who experienced curiosity, desire to explore, and positive affect through a sense of "awe" [27]. Moreover, unsurprisingly, swimmers and freedivers had substantial knowledge of what a dive would be like, which

interfered with their immersion experience fidelity in VR. Furthermore, prior work by Lin et al. considering animal companionship distinguishes between domesticated species [20] and addressing wild animals: unpredictability and unfamiliarity with specific ethologies are essential factors to consider in the interaction. However, the experienced divers' prior knowledge about underwater wildlife also meant that we could trust them knowing of misconceptions about interacting with wild animals.

We found that the EotA VR experience instilled a sense of awe in players, who wanted to wander around, explore the environment, and spend time observing and engaging with marine species, a tension between environmental versus immersive engagement. Players were receptive to environmental design features, such as the presence of the rope, but were less attentive to embodied design features, such as the visual body transformation. Ironically, this may indicate that we successfully directed players' attention away from themselves and toward their engagement with the environment. This is a tension worth exploring in future work.

Finally, EoTA experience means to be holistically transformational rather than convey facts or train specific skills. Like in a real-life freedive, EotA invites users to explore the self and the environment through embodiment and their senses. It opens the doors to noticing, encouraging the freediver to observe underwater life and the relations and interactions from their human body to more-than-human bodies during immersion. We anticipate the transformation manifesting in many different ways, from enhanced perspective-taking [42] to a feeling of connection and empathy for marine wildlife [31] and curiosity and understanding of marine ecosystems [24]. These transformations can be efficient groundwork for ocean literacy when an increased sensitivity for ocean topics is helpful to keep audiences interested and engaged. The challenge of this evaluation needs to be acknowledged holistically.

Nevertheless, it is important to understand the wicked problems that arise from this challenge. We are not seeking to mend the division between human bodies and nature with technocratic solutions but rather facilitating vicinity wherever needed and critically understanding how and when VR can be an effective tool to do so. We are designing further manipulations on the prototype to test different design approaches from the learning of this pilot and testing them with a complete protocol.

Future work

For future research, we are splitting the prototype into different versions to study further how specific design features influence players. We wrote this pictorial to show the design of the prototype, as well as its principles and process. After writing the pictorial we conducted a full protocol study with a much wider number of participants and wrote a full paper, currently under review at a different venue.

Limitations

Some limitations of this work are related to measuring the longevity of its effects on users. While they might feel a transformation right after the experience, this might not last. Another limitation is that this prototype does not scaffold users to become more engaged in real-life ocean-related issues; the implications of any transformation are left for each user to discover.

Notes on the pictorial's design

We wanted to use the pictorial format because the nature of this project entangles with visual storytelling, and it was the best format to convey this. We see the graphic elements as part of it. For example, using the rope as navigation in the paper, going deeper into the abyss serves as a similar narration element, as in EotA guiding readers through the journey. We see the illustrations in the pictorial as integral part of showing our design process as they come from the initial storyboard designs.

Furthermore, the font used in this pictorial is Abhaya Libre and it's designed by Mooniak, a Sri Lankan collective that designs inclusively for local indigenous cultures. We specify this as we want to infuse our positionality into the details of our design as much as possible by choosing inclusively designed elements.

CONCLUSION

This pictorial presented the design and development of EotA, a VR immersive experience of a deep-sea dive. EotA aims to evoke feelings of interconnectedness through virtual water immersion, sensitising users to the more-than-human and challenging anthropocentric perspectives. The experience, guided by animal companions and featuring healing-themed challenges, is designed to be calming and safe. Initial feedback suggests EotA design choices foster curiosity and a sense of connection with marine environments, allowing everyone to engage in conservation efforts, regardless of their physical location.

ACKNOWLEDGEMENTS

We would like to thank Dr. Sarah Fox for her input and support in the initial stages of the project, as well as the playtesters who provided great insights into this project. This work was funded by the Portuguese Recovery and Resilience Program (PRR), IAPMEI/ANI/FCT under Agenda no.26, C645022399-00000057 (eGamesLab); the Bauhaus of the Seas Sails EU-funded NEB lighthouse project through GA 101079995; and

the LoGaCulture Horizon Europe-funded project, grant agreement 101094036. The authors would also like to acknowledge the Portuguese Foundation for Science and Technology, for projects 10.54499/LA/P/0083/2020; 10.54499/UIDP/50009/2020 & 10.54499/UIDB/50009/2020. Research funded by Fundação para a Ciência e a Tecnologia (FCT) through a PhD research grant as part of the CMU Portugal Dual Degree program (PRT/BD/154655/2021).

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