Changing Seasonality

How Communities are Revising their Seasons

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Magnhild Øen Nordahl

17 Simulating seasons in virtual reality

Two Rocks do Not Make a Duck is a sculpture and Virtual Reality (VR) artwork made by the artists Cameron MacLeod and Magnhild Øen Nordahl. It was first shown at the Munch Museum in Oslo and will later be presented at the Arboretum in Bergen in connection to an art exhibition and research symposium on seasonality (Figure 17.1). When a person puts on the VR headset, they will see a simulation of the landscape outside the space where the artwork is exhibited. In Oslo, the river, the fjord and other geographical landmarks were there, but no buildings or objects made by humans (Figure 17.2). A simulated nature-version of the cityscape remained. In Bergen the scene will be recreated to immerse the users in a virtual version of the Aboretum gardens. The user can move through this simulated landscape by moving around in the space where the piece is shown, with the walls of that physical space functioning as movement boundaries also in the virtual world. By lifting and moving around rock-shaped sculptures the user can experience changes in the virtual environment, such as different weather conditions, different times of day and times of year. We called the rocks the weather-rock, the day-rock, and the year-rock. In this text I will describe parts of the process, challenges and some of the technological affordances and limitations in developing a virtual landscape where seasonal changes occur.

We realized early on that to make a virtual environment which *looks* real is something quite different than trying to simulate the complex natural world in a scientifically accurate way. Our knowledge, budget, time, and the point of view from where the user was standing limited what was possible and meaningful to simulate. We had to simplify, to make abstractions, to choose which environmental events to simulate, and to build a whole from those parts with the added building blocks and tools provided by the VR technology.

The exercise of trying to imitate something made us look closer at and learn about what we were imitating. First, we had to think through how the environment changes during a year, what these changes look like, and which changes were possible to simulate. We became aware of things we had not thought of before, such as how the sun makes an analemma (a figure eight shape) on the sky, when observed regularly at the same time of day from the same location. I realized that I knew very little about how the night sky changes throughout the year, and the developers who were tasked with simulating all these things were surprised at how irregular and complex tidal variations are. We were able to include some of these intricate movements and changes in the simulation for free, by using existing software functionality and plugins. Others required more work.

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The environment in the scene would change according to different kinds of time, such as the actual points and speed of clock time in the user's world, compared to the simulated time in VR. When the user starts, the actual and simulated time correspond. The VR scene is thus set up so that the sun is in the same place in the virtual sky as in the actual sky outside the windows of the museum. When the user starts moving the day-rock or the year-rock the simulated time starts to differ from actual time and starts to affect the VR environment accordingly. If a user built a cairn with three rocks (a duck), the VR scene would shift back to actual time so that the simulated and actual time again corresponded. The VR developers had to make a blueprint for the scene that allowed the control over the environmental events to shift between the different kinds of time, depending on the user's interaction with the rocks.

We had to consider how the environment should respond to the movement of the user. Which elements should change, and how fast should those elements change, for example when moving the year-rock? If we simply sped up time and included all the movements in the VR environment, the seasonal shifts would become obscured by all the visual effects of the fast-forwarded landscape timelapse. The sky would switch from bright to dark like a blinking strobe light, with clouds rushing over the sky at enormous speed. We had to reduce the number of things happening in the environment, and to split up the scene so that some elements would be affected by one temporality, and others by another. For example, we decided to keep the time of day unchanged when passing through the year. This meant that while moving the year-rock, the movement of the sun on the sky, and the changes in daylight, were created by seasonal change, and not by the day passing. That is why the previously mentioned analemma appeared on the VR sky. Seeing this figure eight shape appear in the simulation was an indication that the software plugin used for the sky simulation was accurate.

It was challenging to find the right speed for seasonal changes. If too slow, the user would not understand that anything was happening and would not be compelled to move the year-rock. If too fast, the experience would become overwhelming and feel out of sync with the human body and sensory apparatus. We tried many different settings with different test users and realized that the user's experience of the interaction was most intuitive when the speed of the changes in the environment corresponded with the movement of the user's body. If someone moved the rock fast the changes happened quickly, if they moved slowly, they happened slowly. A resynchronization of the body and landscape's time and movement meant that most people understood that their interaction triggered some event, while it allowed them to also just stand still or sit down and contemplate the view.

The museum hosts kept a logbook in which they wrote down how people interacted with the art installation. They also included some of the visitors' comments.

Figure 17.1: Two Rocks do Not Make a Duck, at the Munch Museum in Oslo in 2022. (Photo by: Magnhild Nordahl).

People seemed to really like the starry nights and the changing of seasons, and some spent a long time sitting down on the floor, moving the rock just incrementally. One girl reacted to the piece with a laughing-fit, while two ladies in their 50s called the experience boring and wanted something more action-packed. A man in his 70s and his son experimented a lot with the piece. They lay down, sat on one of the rocks, moved multiple rocks simultaneously and built several ducks. A couple from Italy in their 50s were intent on balancing on top of the rocks, which they both managed to do on top of the day/night rock.

Many people asked about the technology behind the nature-simulation and commented on how being in the simulation made them feel. Several people mentioned that the virtual landscape reminded them of their place of birth. Some people did not recognize that the landscape in VR was a simulation of their current location, outside, while others enjoyed identifying the surrounding landmarks. One woman in her 50s expressed her disbelief at how much time this had taken to film and was even more astonished when she learned that what she was not in a film but a computer simulation. Another woman felt scared and alone, while others were less convinced, noting for example that the fjord should freeze over in the winter. One person commented that it is interesting to think about how much the landscape is affected by humans, and in a review of the show a critic wrote that "all of a sudden the digital world appears more natural than the real".

The digital world was made up of layers of 3D models, many of which were downloaded from the online 3D assets library Quixel. To build them from scratch would require an unmanageable amount of manual computer-work, and common practice is therefore to combine objects from such archives of virtual ready-mades. The 3D models we used were made from 3D scans of nature, capturing only a brief moment in the lifecycle of a plant. To make this plant grow its leaves from buds to full size, to let the leaves fall off and blow in the wind, and to make other elements in nature move in a realistic way, we used existing software functionality and plugins. Using the 3D computer graphics game engine Unreal Engine, 'Ultra dynamic sky' simulates the movement of clouds, 'Volumetric Clouds' makes it look like the clouds interact with sunlight, 'Fluid Flux' is a plugin simulating water in motion and interaction with objects, and 'Speed Tree' is a system simulating a virtual plant's growth. Some of these we could use, others were not compatible with the other parts of the simulation. Speed Tree for example did not have high enough resolution for VR, and its seasonal variation was not detailed enough. Our developer explained that the 3D model of a tree is typically built up by three layers: a stem, branches, and leaves. These are programmed to respond differently to time passing. In fall, a gradually expanding 'invisibility texture mask' on the leaves make them disappear, while the branches and stem remain unaffected. In some cases, it was challenging to make all these parts behave separately and together in

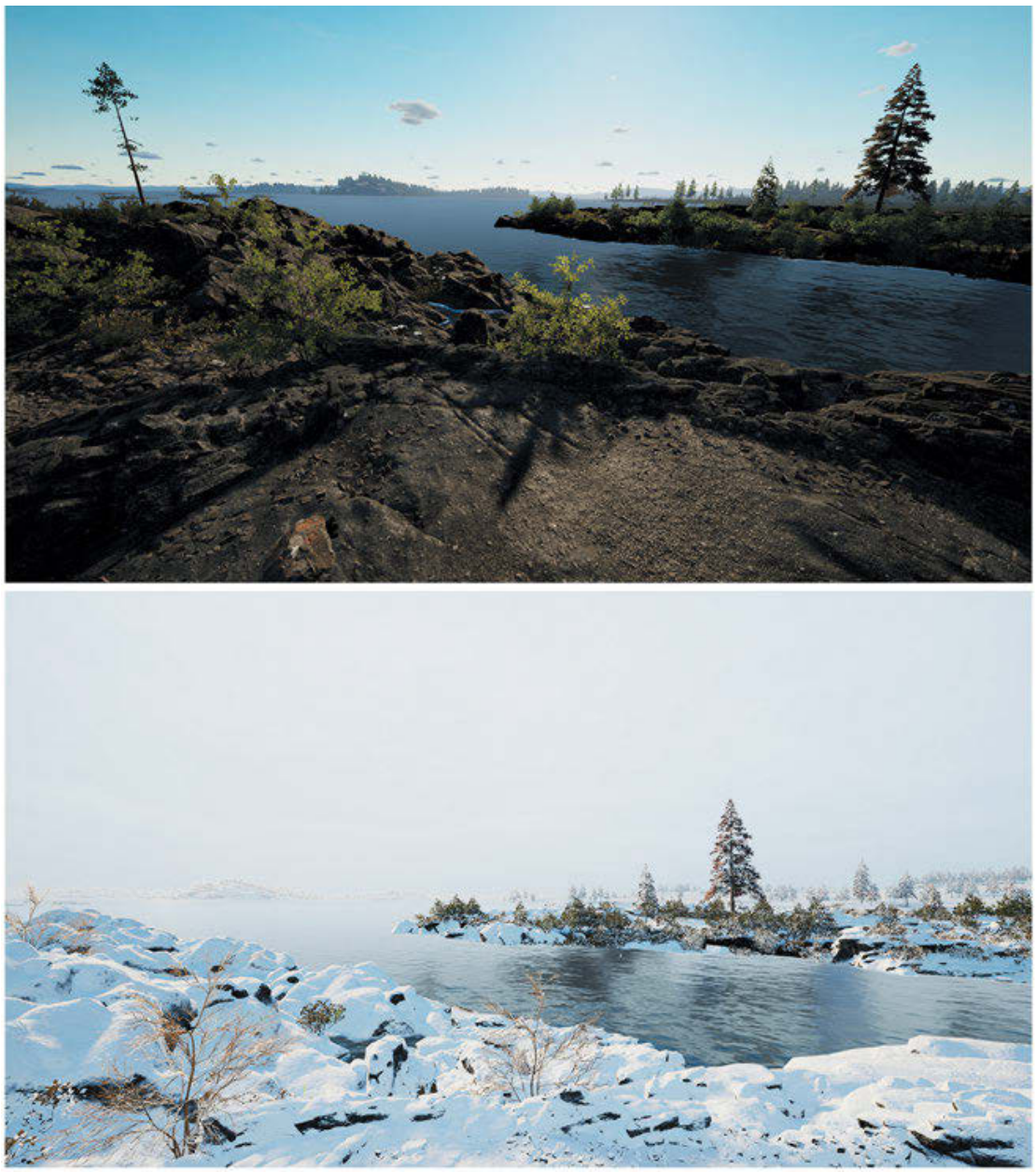

Figure 17.2: The view of the area in VR in different seasons.

the way they should. In an earlier stage of the scene, the stem of the tree was affected by the wind in the same way as the leaves, which made it look like the tree was swaying in some material much denser than air, like a large underwater plant.

Two Rocks Do Not Make a Duck (2022) is a collaborative artwork made by Cameron MacLeod and Magnhild Øen Nordahl. The Oslo-version of the VR scene was developed by Jonathan Nielssen and Jørgen Steinset. The production of the work was supported by The Munch Museum, CALENDARS research group, Bergen Kommune, Billedkunstnernes Vederlagsfond, Kulturrådet and Vestland Fylke.

The author

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Video of the artwork (video credit: Kunstdok): https://www.youtube.com/watch?v=v4FyRTbYCwk