



Secrets of Soil

Henry Driver

“While a speaker explains the soil, the user can navigate through 3D worlds that relate to the explanation. The aesthetic qualities of the experience are wonderful, and it is a joy to listen and learn while looking and moving around.”

ICIDS 2021 Jury

Secrets of Soil

Abstract

Secrets of Soil is an interactive experience into the hidden world of soil. Your journey will take you to a microscopic world to witness the essential life forms that reside there. See how bacteria and plants speak to each other, glide through vast fungal webs, and unearth the secret of how this hidden universe could help save us from climate disaster. The project is freely available online on Steam, as well as on YouTube as a 360-degree video. It can be difficult for people to care about something if they don't empathise with it, so I wanted to use digital art & games to submerge audiences within the soil and allow them to explore this hidden microscopic world. I wanted to reveal that soil isn't just dirt but rather a vital ecosystem full of life, in the hope that this inspires audiences to think differently about soil, to connect to it, and to care for it. To show that arable agriculture and how we look after our soil is an essential part of how we can combat climate change.

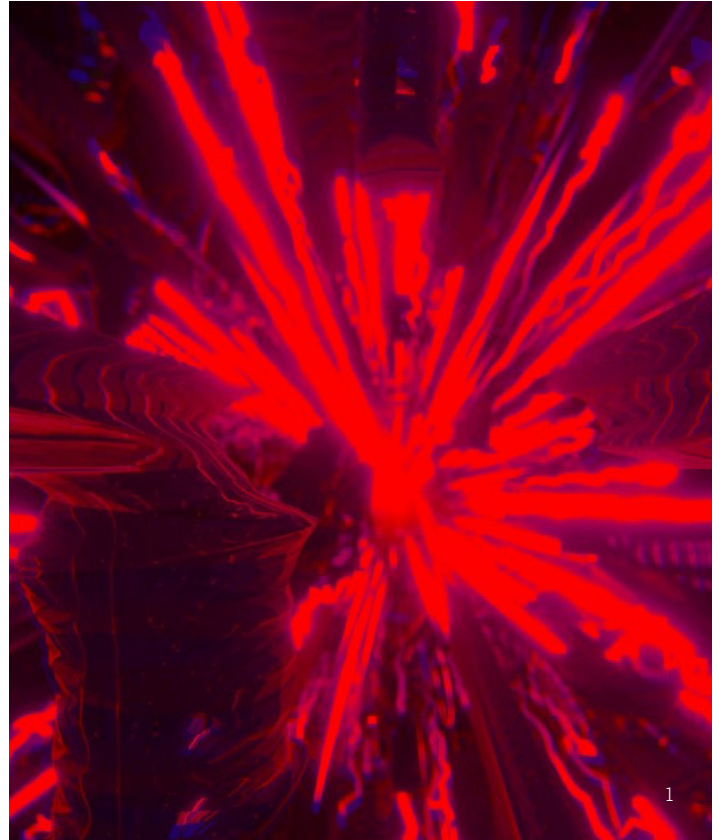
Keywords

Regenerative farming, walking simulator, educational game, BBC New Creatives, climate change

Inspiration

Secrets of Soil was inspired by my family's attempts to make their farming practices carbon negative. They are arable farmers based in Suffolk, UK, growing wheat, oats, beans, barley, and oilseed rape. Over the past decade, farming has become more difficult for them, due to increasingly disruptive weather plus a combination of rising chemical costs and their reduced effectiveness. In 2015, they joined the global regenerative agriculture movement and began to focus on building up the health and biodiversity of their soils, using these to provide nutrients and protection for their crops (rather than relying solely on chemical "inputs").

Central to creating healthy soil is working with the life buried within it. But what lives in the soil? When I realised that soil isn't just dirt and a few earthworms but a whole universe of interconnected life, the early idea of visualising this was spawned. But I need to dive in further.



A teaspoon of soil contains a billion bacteria... but what does that actually look like?

Research

To gain a better understanding of the life buried within the soil, its interactions and our effects upon it, I collaborated with plant science researchers at the John Innes Centre, Norwich, UK. They generously shared and discussed their research and imagery with me. These discussions helped to build up an image of this subterranean world and of the many complex interactions that occur.

Alongside that, I consulted publications and farmers to further understand their techniques for creating healthy soil, as well as to have an industry viewpoint on the past, present and future of farming.

Aims

That period of research provided a wealth of inspiration, as well as solidified my two aims for *Secrets of Soil*. Firstly, to inspire people to think differently about soil. That it isn't lifeless dirt but a vital ecosystem brimming with life that we depend on. I wanted to reveal this to audiences and let them explore it. It's difficult to care for something if you can't see it, or if it's completely unknown to you. With every scene I wanted to build up this world, with more life emerging the deeper the player dives, but also allowing the player to engage with this life, and carry out some of its interactions. I hoped this would connect players to the soil.

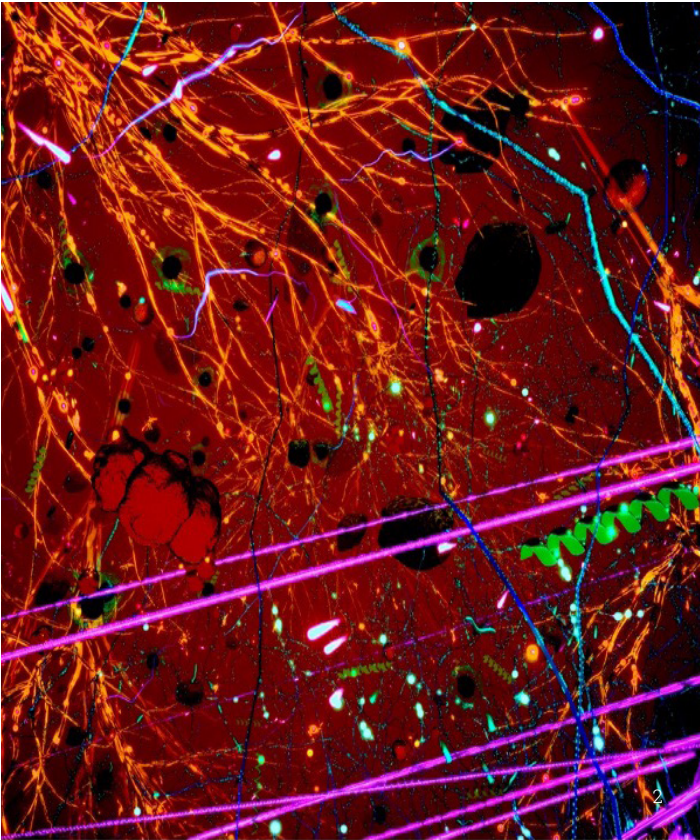
This initial world-building was key to provide context for my second aim: to visualise our impact upon soil. How we look after our soil can be a huge help in our fight against climate change. We have the capacity to destroy eco-

systems but we also have the power to rebuild them and work with them. I wanted to reveal the effects of intensive farming but show there are achievable alternatives. I wanted to allow the player to regenerate the environment to demonstrate this, and provide that connection between player agency and real world impact.

Capturing the wonder of the soil

Visualising the world of soil was tricky on numerous levels. For some parts I could rely heavily on scientific imagery to inspire me, while others required significant artistic licence or imagination. For example, how do you visualise plants and bacteria speaking to each other? I undertook quite a considerable amount of playful R&D and experimental production to build up a toolbox of visual language that I could draw upon. Sometimes my R&D for one scene ended up becoming part of another. That playful

creation and pushing of systems to encourage surprises is integral to my production methods. I strongly believe in there being a dialogue between myself and the software, as well as all the integral parts which inhabit that, such as shaders, models, effects, etc. So for visualising plants speaking, we know they release a dynamic selection of chemicals around their roots to draw in and work with various microbes, as well as fire off chemical signals that trigger plant cell growth to enable symbiosis. This made me imagine a vivid cacophony of evolving signals and particles. It felt like this section needed to be visually striking to represent the sheer number of microbial and plant communications, but also capture a sense of wonder. On a whim I combined a shader I built for another scene with a 3D model and some effects from another, and there it was, this vivid oscillating, yet ethereal plant root model, which just seemed perfect. It reminded me of one of the JIC researchers: Dr.



Myriam Charpentier and her video imagery of calcium signalling in plants roots but if it had been extrapolated into 3D, showing a vaster scale.

The vibrant visual style was inspired by the researcher's microscopic imagery. A lot of the images were fluorescent, which contrasts heavily with the preconception of soil being purely earth textured. Some of the researchers' videos contained flashing lights, as genes within plants fired off and triggered actions. I decided to embrace this vivid and glistening vision and use this as the world's identity. Mainly because it felt so different to what I was expecting or thought soil would look like but also to emphasise the sense of life within this world.

Following on from that, I wanted each scene to have a unique colour scheme or atmosphere, and for this to continually surprise the audience. There is so much wonder buried in the soil, I wanted the art style to do it justice, for

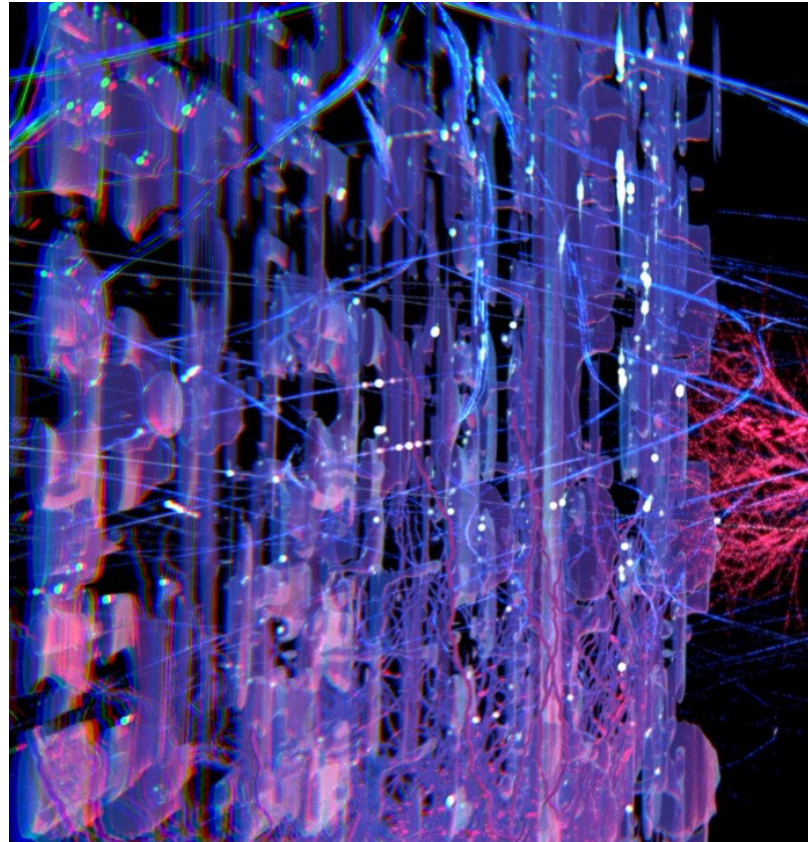
each scene to not only present a new life form or interaction but to also look distinctly different. This was to encourage exploration but also to suggest that this is only a glimpse of a massive world.

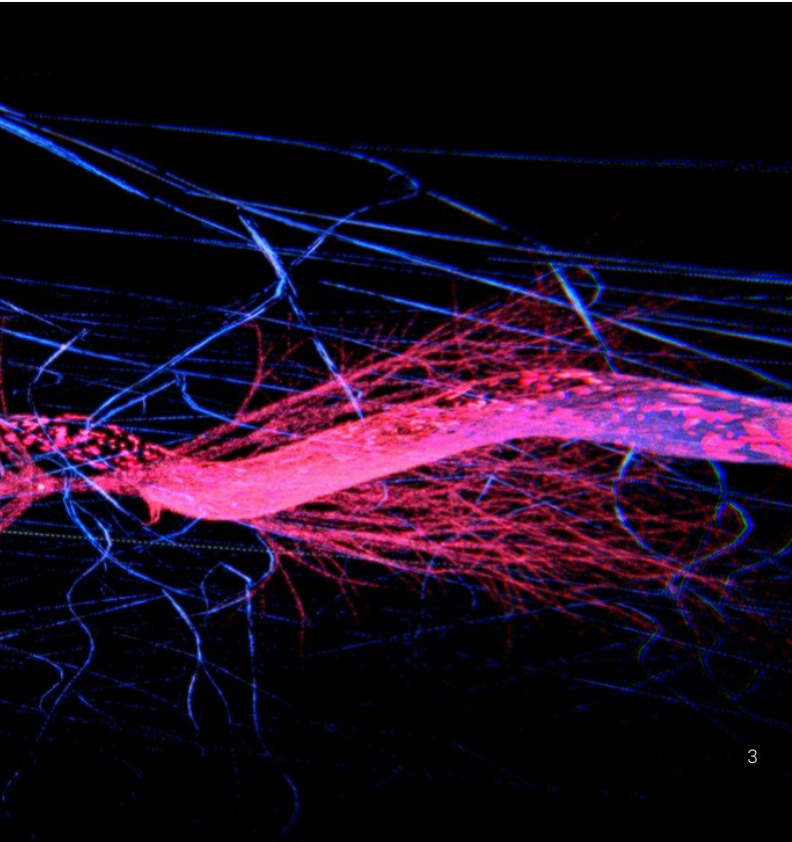
Visualising the scale of the ecosystem and the interconnected members within it was tough. Getting the scale of elements to be vaguely accurate and also creating a world that visually worked, all while staying within the project's budget was a tricky affair. The experience flows between different scales for most of the scenes.

Narrator

Throughout the experience you are accompanied by a narrator.

I wanted the game to hopefully be enjoyed by a range of audiences and ages, but achieving that is incredibly difficult. Initially, I planned to





have a responsive narrative, where the level of information varied depending on the audience's interaction but unfortunately I had to shelve this due to time constraints. When designing and writing the game it was difficult to decide the level of information to include. I wanted to connect diverse audiences to this ecosystem but not bog them down with too much detail. I didn't want the game to feel like a stodgy science lesson. I think the earlier scenes do that best by being succinct, while still containing interesting science. However, the scenes which explore the effects of intensive and regenerative farming, were particularly difficult to shorten, and even after lots editing they're still pretty heavy going. It would have been great to provide more ways of allowing the audience to distil information and knowledge from the environment, via exploration and interaction.

Interactivity: Exploration & Impact

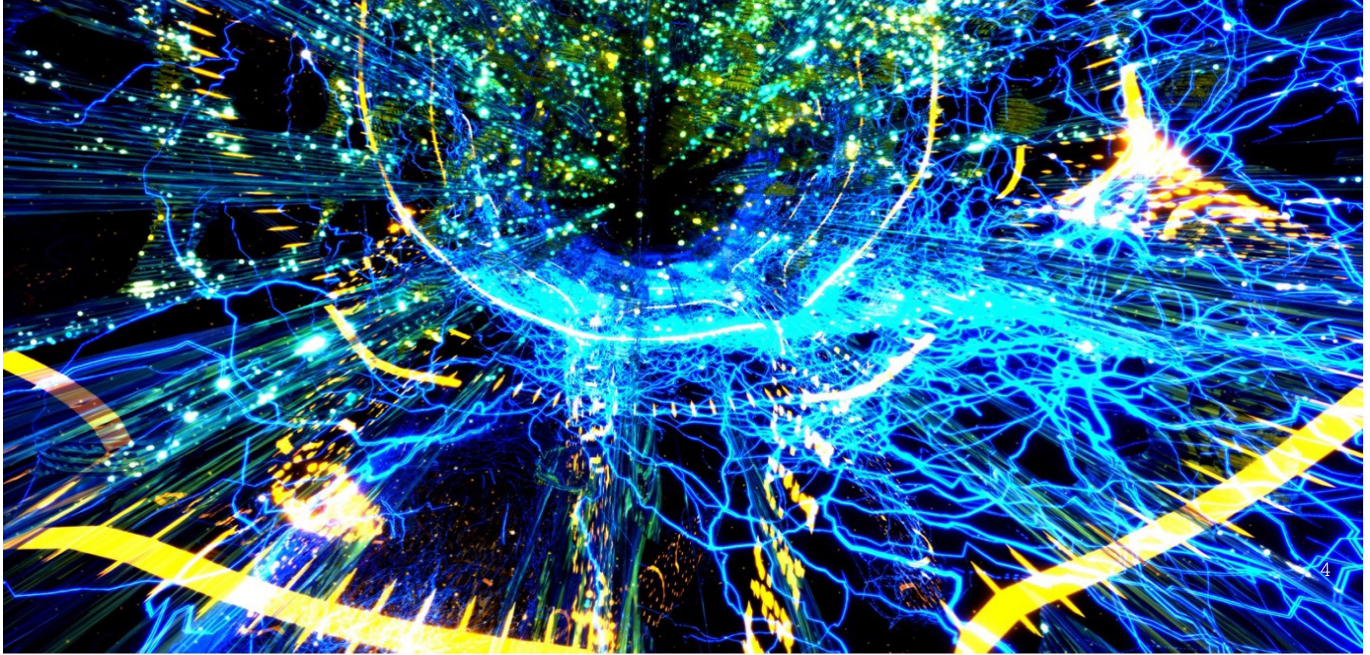
Buried below our feet is a complete world, brimming with life and activity. There is so much to uncover and learn, it felt natural to me to form Secrets of Soil into an explorative experience to navigate this landscape. My earliest and most memorable experiences of video games are those that allowed me to explore a completely new world. I believed that a 3D explorative visualisation of soil could hopefully capture a similar feeling of wonder, as the audience constantly uncovers new environments. Capturing that joy of exploration and discovery was really key.

I was keen to add in interactive mechanics which relied on, and rewarded the audiences for exploring. I was also interested in the player having creative opportunities to change and mould the virtual environment through exploration. To demonstrate an impact and connecti-

ty to the player's presence.

In a number of scenes the visual styling or atmosphere will change depending on the positioning of the player. So as they explore, the colours and feel of the environment changes. While this is easy to implement and is a very simple form of interaction, the results can spiral into complexity. The visual journey of players can vary significantly depending on the 3D positioning of the camera and its proximity with objects. I hoped this would be a playful but simple way to make the process of exploration more interactive and creative for players.

Throughout the experience I also wanted to provide the opportunity for audiences to interact with the many micro-organisms within the soil and discover their functions through play. For example, inhabiting the morphing mass of a protozoa and ejecting nutrients into the soil by eating bacteria. Or communicating with plants to enable and trigger symbiosis with



fungi, or creating earthworm burrow sculptures, that cast out streams of fluorescent nutrients. These simple yet hopefully visually rewarding interactions were designed to connect audiences to these non-human organisms and help understand the essential functions they play within this diverse ecosystem.

However, I had planned to have a lot more player interactions which impacted upon the environment. Initially, I had planned to give the player a number of actions that they could do to regenerate soil which had been degraded by intensive agriculture. I wanted to link player agen-

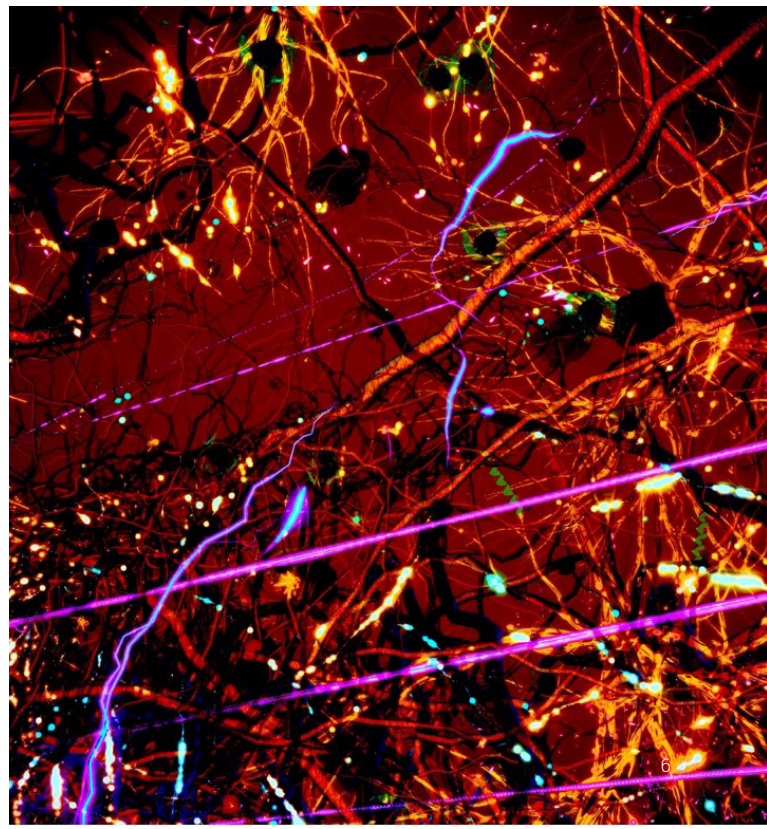
cy to having an impact on an environment, and visualise the changes to practises arable farmers can make and their effect upon the soil. But I struggled to devise ways to make these interactions feel right and fit within the stylings of the experience. I found it difficult to create intuitive gameplay based around them which was fun, while still being scientifically and agriculturally accurate. My original ideas for these sections no longer felt appropriate or cohesive to the experience as a whole. It was also at this stage that I got caught up on the script writing which was a massive time sink. In the end, I resorted to the

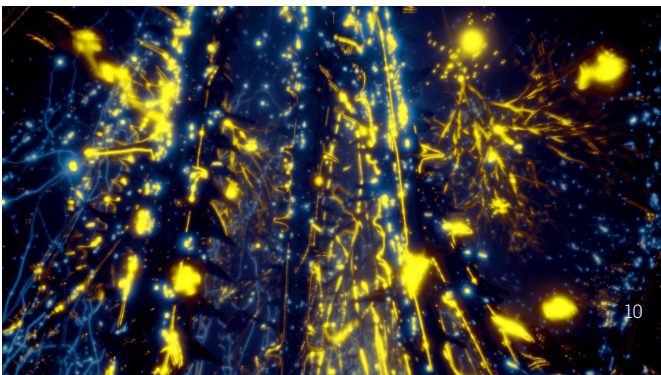
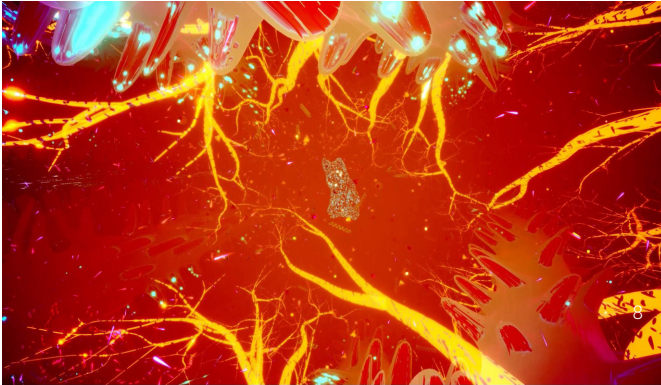
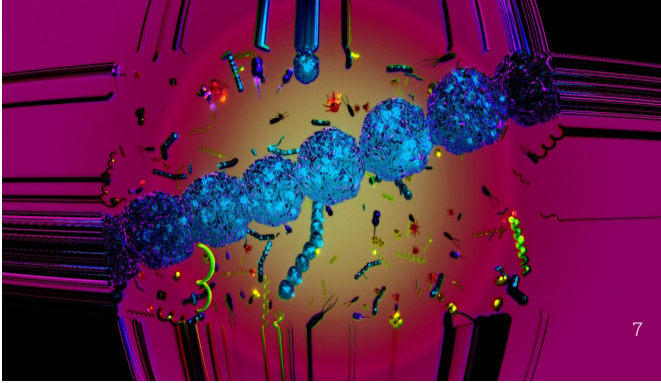
player using a single button press to regenerate the soil, which provides a dramatic if simplistic effect. But at the time I liked it, because it demonstrates the immediacy of switching to regenerative farming practises. Where the farmer can change and instantly start to reduce their environmental impact. However, it's important to state that there will normally be a transition period before the farmer can fully reap the benefits of regenerative farming.

At the end of the experience there is a link to activities for looking after the soil. It was important for me to provide accessible actions that anyone can do to help out. It's something I really want to further develop in my future projects.

Reception

Secrets of Soil combines games design with science, art, farming and education. The resulting chimera is a visually striking yet educational interactive experience which has been shown across the world at

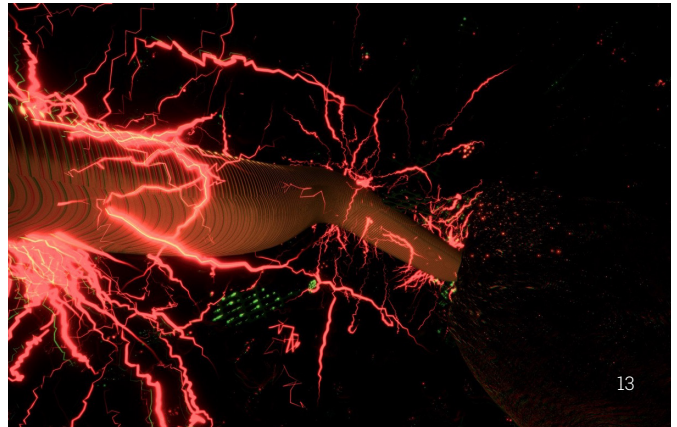
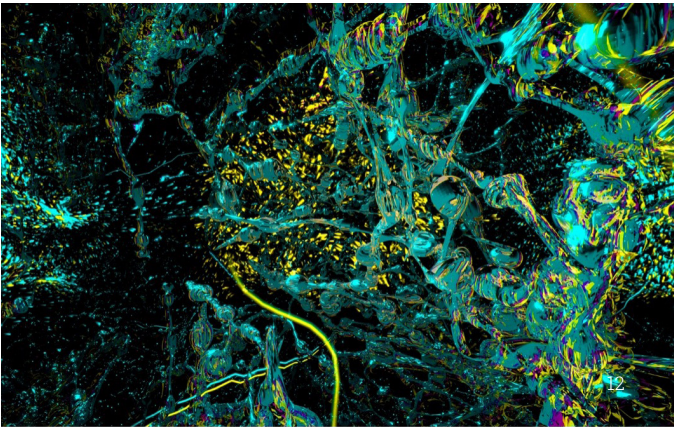


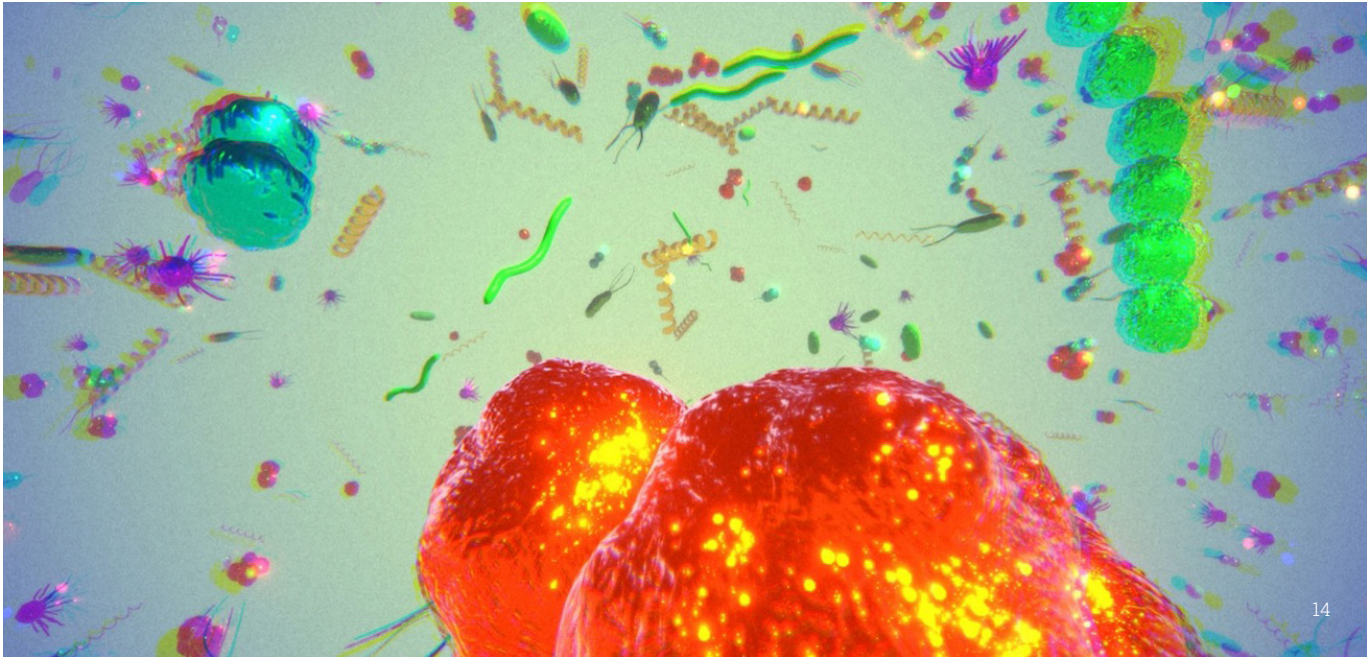


games and film festivals, farming conferences, art galleries, hospitals and schools. The work received praise from games media, where it was described as a “hypnotic pleasure...Driver turns this subterranean odyssey into something truly fantastical: colonies of swarming bacteria and glowing fungi are made to look like alien worlds, with the sort of palette you’d normally associate with games from Mizuguchi and Minter” (Edge 2021) and Lewis Gordon: “A spectacular underground cosmos. It’s everything I wish my educational software at school could have been” (2021).

Looking Back

Looking back on *Secrets of Soil* is a bizarre experience because I have learnt such a colossal amount in the year since its release. That sounds like a cliché statement that could be said after every project but it’s truly the case. The project





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was my first attempt at creating a distributed interactive environmental experience, and the process of creating it was a huge learning curve. I'm excited by the reach, responses and feedback from the project, to use these to really improve my future projects within this realm. But equally there's a large number of elements which need to be vastly improved to increase the impact, availability, accessibility, and sustainability of future works. I feel that *Secrets*

of Soil achieves part of its goal of connecting audiences to the soil and our impact upon it but in a specific way that only works for certain people. I think there's considerable room to expand the interactivity, accessibility, and storytelling to provide a much more rounded experience to connect a larger audience to the soil.

References

Edge Magazine (2021, November, 22) Future Publishing

Gordon, L. (2021 July 19) Discover A Spectacular Underground Cosmos In 'Secrets of Soil' Vice Waypoint. <https://www.vice.com/en/article/xgx573/discover-a-spectacular-underground-cosmos-in-secrets-of-soil>

Images

1. A nutrient-exchange point inside a plant preparing for symbiosis with fungi.
2. A vision of healthy soil containing a variety of bacteria, fungi, and plants.
3. Plant matter on the left and a nematode on the right being drained of nutrients by fungi.
4. Fungi hyphae entangling around plant roots, as well as entering them to create symbiosis.
5. Fungi and bacteria decomposing organic matter.
6. Fungi and plant roots.
7. Selection of soil bacteria.
8. A selection of plant roots, with a protozoa in the center.
9. An ecosystem in decline.
10. Plants communicating with bacteria, visualized through flashing lights.
11. A plough breaking apart soil ecosystems (leading to loss of soil and the carbon stored there).
12. Antibiotic-creating bacteria, inspired by Streptomyces imagery.
13. A nematode releasing nutrients into the soil
14. Soil bacteria

All images © Henry Driver 2021

Credits

Concept, art, design, coding, and sound by Henry Driver. Voiceover by Lynsey Murrell. Script assistance by Sam Snape.

Commissioned by Screen South and BBC Arts; produced by Collusion.

Executive producers: Jo Nolan and Peter Richardson.

Thanks to the John Innes Centre researchers & support staff.

Acknowledgements

New Creatives is a talent development scheme offering commissioning opportunities for emerging creatives to make new artistic works in film, interactive media, and audio, designed for BBC channels and platforms. It is supported by Arts Council England and BBC Arts.

Download the interactive version here:

https://store.steampowered.com/app/1610820/Secrets_Of_Soil/

Experience the 360-degree video version here:

<https://www.youtube.com/watch?v=6eSVAsOJD9E>

Read the BBC article here: <https://www.bbc.co.uk/programmes/articles/1gbmnLVfKyJdCd1VBVWlc6/new-artwork-reveals-theres-more-to-soil-than-meets-the-eye>

Henry Driver is an artist based in Suffolk, UK. He has shown work in Australia, Canada, Czech Republic, Denmark, Estonia, Germany, India, Japan, Portugal, South Korea, USA, Turkey and Taiwan. In his home country (the UK), Driver has shown at Tate Britain, Tate Liverpool, Barbican, and the Whitechapel Gallery.

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Medium: HTML, CSS, js, mp3

Year of Release: 2020

Link to the artwork: <https://kaaathy.com/office/index.html>
(use mobile device for best results)

Artist website: <https://kaaathy.com/>