MARC BOURCIER/CONCORDIA UNIVERSITY.

Ursula Eicker and her colleagues have built a gamified tool for urban planning.

TURNING CITY PLANNING INTO A GAME

Ursula Eicker lets people play a game to design the cities of the future. **By Brian Owens**

Ursula Eicker builds 'digital twins' of cities, and she hopes to someday build one for yours. Her research team creates sophisticated computer models to explore how building materials, energy sources and people's mobility patterns affect the energy use and carbon emissions of a city or neighbourhood – then makes the models accessible, so more people can get involved.

From the beginning of her career, Eicker knew she wanted her work to make a difference in the world. "I wanted to be in an applied domain where I could have some impact on my surroundings," she says. She earned her PhD in physics by researching materials for solar cells, and then worked for a company developing solar cells. She later returned to academia as a professor at the University of Stuttgart in Germany, researching energy efficiency and how to integrate renewable technologies into buildings.

Now, as co-founder of the Next-Generation Cities Institute at Concordia University in Montreal, Canada, Eicker has broadened her research from single buildings to whole cities. "From doing materials research on semiconductors for solar cells to now looking at entire cities, it's quite a way to go," she says.

The digital twins that Eicker's team builds are powerful modelling tools – but, because they are complex and data-intensive, they are generally used only by experts. That's something Eicker wants to change. "We want more people to use [these tools] in an easier, more accessible and more playful way," she says.

So the team harnessed the Unity video-game engine, essentially a software-development workspace that is optimized for quickly and easily building interactive video-game environments, to create Future City Playgrounds. This puts their complex scientific models behind the scenes of a computer game, creating a sort of *Minecraft* for urban design. "You can change the parameters of your simulation models in a game and send that back to the computational engines and then see what that does for your carbon balance," she says. "It's still running pretty serious scientific calculations in the back end, but the user doesn't see that any more."

In the game, users can play with a digital version of Montreal: they can shape a single building or cluster of buildings to simulate a neighbourhood retrofit project, click on surfaces or streets to modify them, or design buildings in empty lots to see how changing materials or adding clean-energy systems can affect the neighbourhood's character, energy use and emissions. The goal of the game is to create the most sustainable building with a budget of $1 million – for example, by adding

spotlight

highly insulating but expensive windows, optimizing the arrangement of rooftop solar panels or using rooftop vegetation to moderate demand for heating and cooling.

A larger web-based version of the project that does not use the game engine allows users to see the effects of city-wide changes – such as how retrofitting 50% of all buildings in Montreal built before 1950 would affect the city's carbon footprint.

The first real-world outing of the Future City Playgrounds project was Eicker's entry in Montreal's 2021 Reinventing Cities competition, run by C40, the global network of cities dedicated to addressing climate change. The competition brought together teams of architects, developers, academics and planners to design climate-friendly uses for a specific site in their city. Eicker's team used their game engine to create a redevelopment of an old factory building along Montreal's Lachine Canal, incorporating a heat-pump system that used the canal water to supply heat to the building.

They earned second place, so that project will not be built. But Eicker's team repurposed their ideas to retrofit another old factory overlooking the canal. That building was given one of the first zero-carbon certificates in Montreal, but still requires carbon offsets because it uses a gas boiler. The team is working with developers to get its canal-water heat-pump system into the building. "We are basically pursuing the same idea of connecting it to the canal water," she says. "It will be exciting to see that get built in the near future."

The team is working to add measures of liveability into the tool – that is, how things such as parking management, bicycle access and social spaces can make a building or neighbourhood more appealing. "Of course that is much more subjective, and much more difficult to come up with good indicators," says Eicker. But adding those aspects is essential to ensure that the sustainable cities of the future are equitable and comfortable places to live.

Eicker's ultimate goal is to have a tool like Future City Playgrounds available for every development, so people in local planning meetings can get more involved in designing the evolution of their neighbourhoods. "It's more than an academic exercise, and more than a game," she says.

"If you want to transform the city towards the most sustainable future, it's not just about technology," Eicker says. "You need people involved. You need the participation, acceptance and social inclusion of the people living there."

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DUNCAN WILSON

A smart monitor in London's Queen Elizabeth Olympic Park records bat activity.

WHAT BATS CAN TEACH US ABOUT URBAN DESIGN

Kate Jones thinks the natural world can inspire a dialogue about cities that are sustainable and healthy for humans and animals.

When I was an undergraduate student at the University of Leeds, UK, I volunteered to help out with a bat-conservation study. Someone put a tiny common pipistrelle (*Pipistrellus pipistrellus*), the country's smallest bat species, in my hand, and it was love at first sight.

I've always been fascinated by nature. Growing up, I fancied myself becoming a cross between David Attenborough and Indiana Jones: Dr Jones, wildlife adventurer! But it was during my university module on bat ecology that I knew I'd found my path.

These days, my research focuses on the interface between ecological and human health, and I use bats as a springboard for investigating some of life's big questions. For example: how can we design cities in a way that's sustainable for both humans and nature?

Bats are amazing. They're also weird – they have a lot of traits that are unusual in mammals. Take their lifespan: there are bats that live for around 40 years, whereas a mouse the same size lives for an average of just 18 months.

The fact that bats break evolutionary rules really helps to illustrate how much we don't know about ecology and the wider world we live in. Studying bats has helped us to understand more about areas including sonar, echolocation, acoustics, biodiversity, infectious diseases, longevity, metabolic stresses,