Ocellus XR

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Abstract

Ocellus XR is a mixed reality application that leverages the Urban Systems Lab's Data Visualization Platform to present users with unique interactive geospatial maps of heat, flood risk and other climate indicators in New York City. Integrating environmental studies and data visualization into place-based research on social vulnerability and equity, the app provides a novel experience to understand climate risk, allowing users to explore first-person 3D visualizations of social-ecological-technological data by projecting interactive maps and proposed resilience interventions onto physical surfaces and experiment with augmented reality layers. The Ocellus XR project builds on the USL's expertise in advancing spatial agent-based modeling, machine learning, social media data, and cutting-edge visualization of urban social and infrastructure systems to ask better and new questions about key climate change risks and opportunities to advance adaptation in cities.

Keywords: Data visualization, augmented reality, climate risk, social vulnerability, location-based

Index Terms: [Data Visualization]

1 Introduction

The Ocellus data visualization platform is pre-loaded with state-of-the-art research data and spatial maps organized around social, ecological, and technological principles [1]. It is designed to support spatial storytelling and collaboration, built on open standards and popular software libraries, anticipating the full lifecycle of research collaboration. With the goal to engage and support public stakeholders and research teams, Ocellus addresses the challenge of bringing different spatial data products into one coherent visualization environment and sharing outcomes with public audiences. This project explores where and how vulnerable populations are exposed to three major impacts of climate change in cities: heat waves, coastal flooding, and extreme precipitation. Bringing social, ecological, and infrastructure data together in a place-based XR application allows users to explore locally relevant climate indicators in a novel 3D interactive mapping environment, experiment with first person augmented reality on the streets of New York City, and project maps onto a physical surface and displaying social, ecological and technological data layers with stakeholders and communities.

2 Theory

Ocellus draws from theories of spatial representation developed by David Harvey who articulated three spatial classifications in considering the perspective and context for users: absolute, relative and relational. Alongside a consideration of these spatial categories, the Ocellus project builds on popular theories of visual design, statistical analysis and computer science to create dynamic representations that shift between narrative and spatial modes to engage audiences in reading geospatial information. As cities face urgent social-ecological crises, there is an increasing need to rapidly respond with novel urban design interventions. To date, there are few ways for communities to understand where, how, and when vulnerable populations are exposed to heat waves, coastal flooding, and inland flooding. Further complicating this, urban planners and architects do not have adequate tools for creating participatory processes to inform decision-making.

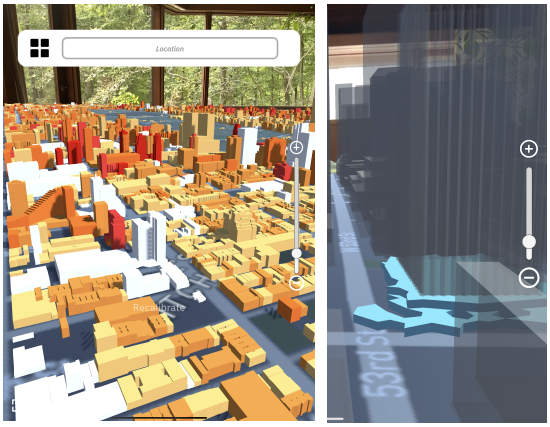

Figure 1: Table-top AR view of heat and flood risk in Manhattan.

3 Discussion

How can state–of-the-art spatial data visualization of water, energy, and transportation infrastructure communicate social vulnerability and improve risk mitigation in the New York metropolitan area? Can the introduction of the Ocellus data visualization platform advance understanding of social-ecological data (eg. health, heat, flood) and model outputs, improve science communication, and engage local stakeholders in novel scientific data and effective disaster avoidance? We hypothesize that in visualizing multiple spatial data on infrastructure systems, there is potential to improve local resiliency planning, and provide a reproducible framework for other cities to leverage. Ocellus XR addresses this need, bringing social, ecological, and infrastructure data together through a mobile app and web platform for exploration of where, how, and for whom to build resiliency. The aim is to help shift thinking and understanding around climate risk data at varying scales, view proposed resiliency efforts in real-time, and catalyze participatory planning processes. This may increase the speed for interventions and community feedback, improve community visioning, aid in visualization and inform adaptation practices in cities that center the voices of frontline communities.

4 Conclusion

Ocellus XR extends spatial mapping to a immersive augmented reality context, allowing users to explore spatial maps and infrastructure data on their mobile devices and (a) virtually visit a remote locations, and (b) discover spatial data live at street level, including flood projections, heat data, cooling centers, alongside green infrastructure and demographic datasets. Designed as a location-based mobile app, the goal of Ocellus XR is to enable coproduction and make climate data relevant for local communities. The Ocellus XR and web application creates a powerful framework with state-of-the-art visualization capability which is both flexible and portable. We hope to further leverage spatial visualization as a means to not only visualize risks but to also change how we think about, plan, and design our cities.

References

[1] Sauter, D., McPhearson, T., Randhawa, J., Tomateo, C., & McPhearson, T. (2020). Visualizing urban social-ecological-technological systems. In *Resilient urban futures* (Ser. The Urban Book Series, pp. 145–158). Springer Nature.