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Geoff Boeing is an Assistant Professor in the Department of Urban Planning and Spatial Analysis at USC's Sol Price School of Public Policy. He received his Ph.D. in City and Regional Planning from the University of California, Berkeley in 2017 and completed a postdoc in Berkeley's Urban Analytics Lab in 2018. Boeing's research revolves around city planning, urban form, and spatial data science. Recent projects have focused on (1) the nature and character of urban transportation networks around the world and (2) how spatial technologies and their data exhaust shape our understanding of housing affordability. He developed and maintains the OSMnx spatial network modeling software and has served as a spatial data science consultant for various planning, policymaking, and public health organizations including Calthorpe Associates, The Public Good Projects, UrbanSim Inc, Accenture, and Raimi & Associates. Boeing delivered the 8th annual Transactions in GIS plenary address at the 2019 AAG annual meeting in Washington DC, focusing on the intersection of his research on transportation networks and spatial data science. He has previously presented this research in a plenary address at the Architect of the Future conference in Moscow and in invited talks at the Venice Biennale, Stanford, Harvard, Cornell, Columbia, NYU, the University of Chicago, and many others. Hiw work visualizing spatial networks was shortlisted by the 2018 Information Is Beautiful Awards and the 2019 NetSci Visualization Awards. His related research has been profiled by *Forbes, Slate, The Washington Post, The San Francisco Chronicle, CityLab, Fast Company*, and other media outlets.

Setting the Spatial Data Science Agenda

Several years ago, Google's CEO Eric Schmidt famously noted that humankind was producing as much data every two days as it had produced in total from the dawn of civilization through 2003. Today this volume is far higher. However, the uneven production of spatial big data shapes and biases our production of urban knowledge—and in turn, for whom we plan. Throughout its history, urban planning has reproduced racial and gender inequalities and has entrenched poverty under the guise of scientific equanimity, expedience, and rationalism. But as academics, we have a critical platform to speak truth to these power structures, question the status quo, and support disadvantaged communities. Rather than trying to endlessly "solve" the city, how can we instead empower

marginalized individuals and communities to be their own best advocates in more diverse, just, and inclusive public planning processes that leverage spatial data science. This, in a nutshell, is my motivation and means of approaching the field. I engage spatial data science from the theoretical and professional perspective of urban planning, studying cities through emerging big data sources and probing spatial technology platforms like OpenStreetMap, Uber, and Craigslist. My work accordingly focuses on two interwoven empirical pillars: (1) how urban transportation network structure impacts access and equity and (2) how new spatial technology platforms shape residential mobility, neighborhood segregation, and the scientific mode of urban inquiry.

I am the creator of OSMnx, a popular OpenStreetMap spatial network analysis research software toolkit that has been downloaded and installed by users over 100,000 times since last year. I developed this platform to model street networks at various scales worldwide to draw connections between planning decisions, access, and equity. Through a combination of spatial analysis, topological network analysis, and big data collection/management, my empirical findings identify critical points for spatial segregation, infrastructure resilience, and the distribution of accessibility at multiple scales, revealing how the urban form connects and segregates us. I have extended this work by simulating urban growth, travel demand, and consequent energy consumption using a high-performance computing cluster to explore emerging scenarios of ride-hailing platforms and autonomous vehicles.

I have also made available over 110,000 graph-theoretic street network models (containing hundreds of millions of geospatial elements) in the Harvard Dataverse for anyone to analyze and study. This massive spatial data repository gives scholars and planners a new ability to quickly ramp up accessibility, segregation, and resilience analyses. In the nascent age of autonomous vehicles and mobility-as-a-service, I am particularly interested in leveraging these methods and big data to critically rethink the built environments and urban fabric we produce that underlie our ever-evolving transportation paradigms.

My other concurrent research pillar interrogates how technology platforms and digital information supplies shape housing markets—as well as our understanding of opportunity and affordability within them. I collect and analyze millions of online rental listings to explore how these information exchanges function. I find that online listings spatially concentrate and overrepresent whiter, wealthier, and better-educated communities. Although the Internet promises information democratization, I use big data exhaust to demonstrate how technology and information channel segregation can instead exacerbate historical patterns of residential segregation and inequality.

Today, urban planners increasingly need spatio-computational skills to understand and influence the modern world. But reciprocally: understanding planning, politics, power, and local context is essential for critically interpreting any insights from urban data. My work is grounded and interdisciplinary. I have ongoing research collaborations with computer scientists, mathematicians, civil engineers, geographers, sociologists, and architects. Organized around the high-level theme of planning and spatial science, my work bridges the adjacent topical fields of transportation, housing, and urban design: each represents an essential facet of complex urban systems. Synthesizing these fields, I

organized the session on Emerging Computational Methods in Urban Design at the 2017 ACSP conference and presented in the 2018 ACSP Big Ideas Session on Civic Analytics and Urban Science. My long-term agenda integrates this work on transportation networks and housing to examine accessibility and segregation, sprawl minimization, the connectivity and equity of new neighborhoods incentivized by the LEED-ND standards, and how emerging technologies shape housing and mobility justice. All of this is underpinned by my ongoing methodological research and development of geospatial tools and visualization methods.

The urban planning discipline suffers from deep tensions, contradictions, and biases. To better serve the needs of the many, our communities need the diverse contributions of a broader range of perspectives. I hope to foreground and center marginalized voices in the planning conversation. I focus my methodological research on developing new tools and techniques that democratize spatial data science to bring more diverse community voices into planning debates otherwise dominated by technocracy. My empirical and theoretical work explores how new technologies and algorithms might foster justice and inclusivity, rather than merely automate and reproduce historical spatial injustice and exclusion. At the end of the day, as academics we are responsible for building a more diverse and inclusive future for the urban planning discipline.

Spatial data science sits at the very heart of this critical, unfolding process.