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Peter Mörtenböck and Helge Mooshammer, eds.
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ISBN 978-94-6208-615-9
Order Online on nai010.com

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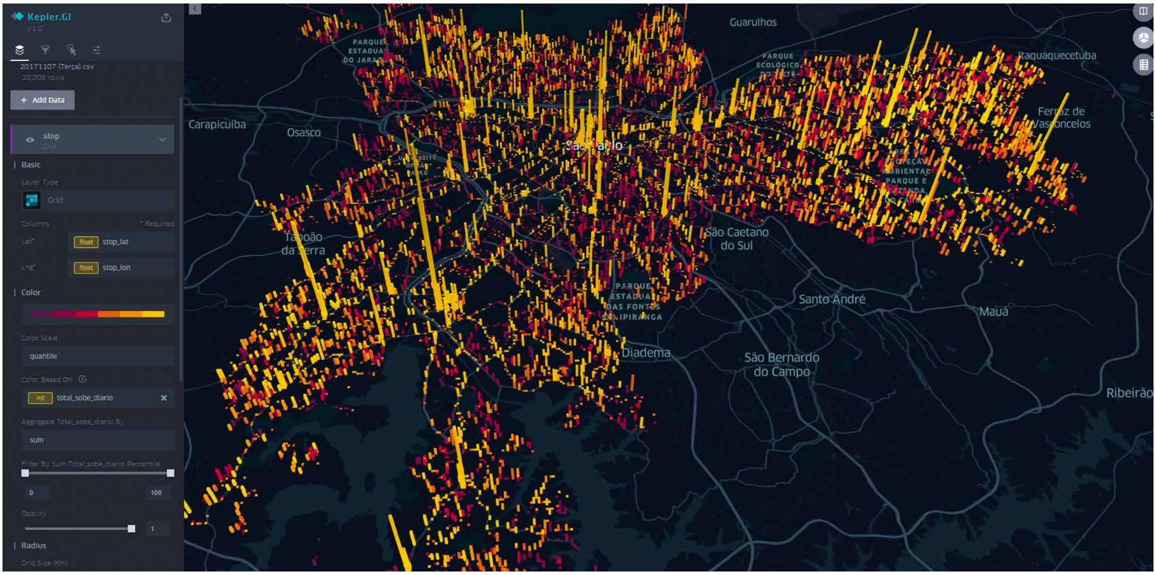
Unsettling Placelessness

Governing by Data

Architectural Science in the Steel City

Imagining Other Platforms



Uber's Kepler.gl platform for urban simulation and visualisation is used by the company to predict demand based on user data. The platform was made open source. Image credit: Renato Arbex.

Urbanism | Smart Cities | Platform

Unsettling Placelessness

Stories about smart cities borrow from techno-discourse a tendency towards placelessness that works to obscure the irreducible specificity of the urban. In these written interventions, I will focus instead on a very specific site: Pittsburgh, the city where I live, and whose ongoing history of post-industrial decay and technological reinvention looms large in the imaginary of the smart city. With Pittsburgh as both a subject and a site, these pieces of writing aim at delivering a few short historical, speculative, and personal sketches aimed at situating, unsettling, or playfully reconfiguring the fantasies of prediction and control that underpin smart city ideology.

I have a particular interest in these questions. At the School of Architecture at Carnegie Mellon University I direct a research programme aimed at rethinking the role of computation in processes of designing, making, and building. I am especially interested in how digital technologies are imagined as participants, modulators, or enablers of design processes, and in approaching these imaginaries as worthy subjects of critical inquiry and creative intervention. From this perspective the move to cast cities as subjects of optimisation or predictive inference – and the conceptual shifts this move inscribes for notions of urban governance, ownership, and human life – deserves careful scrutiny.[1]

As the slippery rhetoric of smart city discourse inconspicuously brings computational logics to urban governance and, increasingly, to urban life itself, the pivot towards platforms has the potential to help make these shifts more visible. Centring platforms as objects of urban study, re-making them into urban *objects*, begins to uncover important questions. What happens to urban life when the city itself is imagined as a platform for intensified regimes of data capture and analysis? What can architectural modes of inquiry do to illuminate, challenge, or subvert these logics?

1 See Peter Mörtenböck and Helge Mooshammer, "Platform Urbanism: City-Making in the Age of Platforms," in *Data Publics*, Design, Technology and Society (London: Routledge, 2020) and Ashlin Lee, Adrian Mackenzie, Gavin Smith, and Paul Box, "Mapping Platform Urbanism: Charting the Nuance of the Platform Pivot," *Urban Planning* 5 (13 March 2020): 116. https://doi.org/10.17645/up.v5i1.2545. For a critical perspective on smart city discourse see, for example, Rebecca Williams, "What's so Dangerous About Smart Cities Anyway?" *rebeccawilliams.us*, 16 December 2020, https://rebeccawilliams.us/Dangerous-Smart-Cities; Shannon Mattern, "A City Is Not a Computer," *Places Journal*, 7 February 2017, https://doi.org/10.22269/170207; Shannon Mattern, "Interfacing Urban Intelligence," *Places Journal*, 28 April 2014, https://placesjournal.org/article/interfacing-urban-intelligence/.

Governing by Data

At a recent meeting at Hamburg Hall, the home of the Heinz College of Information Systems, Public Policy and Management, an interdisciplinary group of faculty and students from across the university's five colleges gathered to discuss efforts to combine 'technology and policy to transform city life.'[2] The meeting included short presentations of projects supported by a recent round of grant support, including technical frameworks for smart traffic control, VR technologies for urban design, and computational analysis of data about pedestrian movements in street intersections. A participant explained the vision to 'leverage technology and policy innovations, and interactions between the two, to dramatically transform the quality of life in metropolitan regions' and to 'develop twenty-first century solutions to the challenges facing [cities].'

Before Pittsburgh acquired its reputation as a technology, education, and health hub, or became the launchpad for Uber's autonomous cars, it had long been a laboratory for the application of computational approaches to urban questions. Since the 1950s the federal and city governments, in partnership with community organisations and universities, supported multiple efforts towards urban renewal and community development. Important among these was the federally mandated Community Renewal Program (CRP) initiated in 1959 to incorporate community development concerns along with transformations in the physical structure of the city, which was the first to experiment with computers and simulations in urban design.[3]

Pittsburgh's early ventures into computational urban projects can be seen as illustrations of a broader post World War II conjunction of military and urban expertise. As historian of science and technology Jennifer Light writes, '[i]n a climate of concerns about reducing urban vulnerability to atomic attack, military strategists, urban planners, atomic scientists, social welfare advocates, and local government officials came together for a sustained conversation about improving the nation's physical and social infrastructure in the post-war period.'[4] These collaborations effectively sought to transfer the perceived successes of the US military, including its use of computer simulations, to what was understood as the new battlefield: the post-war American city – and Pittsburgh was a textbook example of both its pitfalls and opportunities.[5]

An apt illustration of this alignment is the 'Lowry model,' an early urban simulation developed in the early sixties by Ira S. Lowry, a RAND corporation researcher working in the city.[6] Lowry sought to model the dynamic evolution of cities by relating factors such as population, employment, tax revenues, demand for public services, and land use. His model, which was implemented as a computer programme with the help of Carnegie Tech faculty, was the root of a host of predictive urban simulations which continue to be used by urban planners today[7]. It also shows how in the social and intellectual ecosystem of the post-war period computers started to creep into the frame of urban planning, policy, and design.

2
Carnegie Mellon University, "Metro21: Smart Cities Institute," accessed 4 January 2019, https://www.cmu.edu/metro21/index.html.

3
Jennifer S. Light, *From Warfare to Welfare: Defense Intellectuals and Urban Problems in Cold War America* (Baltimore, MD: Johns Hopkins University Press, 2003), 57.

4
Light, *From Warfare to Welfare*, 3.

5
Light, 58.

6
Ira S. Lowry, "A Model of Metropolis," The RAND Corporation, August 1964.

7
See, for example, William Goldner, "The Lowry Model Heritage," *Journal of the American Institute of Planners* 37, no. 2 (1971): 100–110; Meir Gross, "The Lowry Model of Land Use Simulation and Its Derivatives," *Computers, Environment and Urban Systems* 7, no. 3 (1 January 1982): 197–211.

An iterating question may be: how did these moves shift the intellectual centre of gravity of nearby architectural educators and researchers?

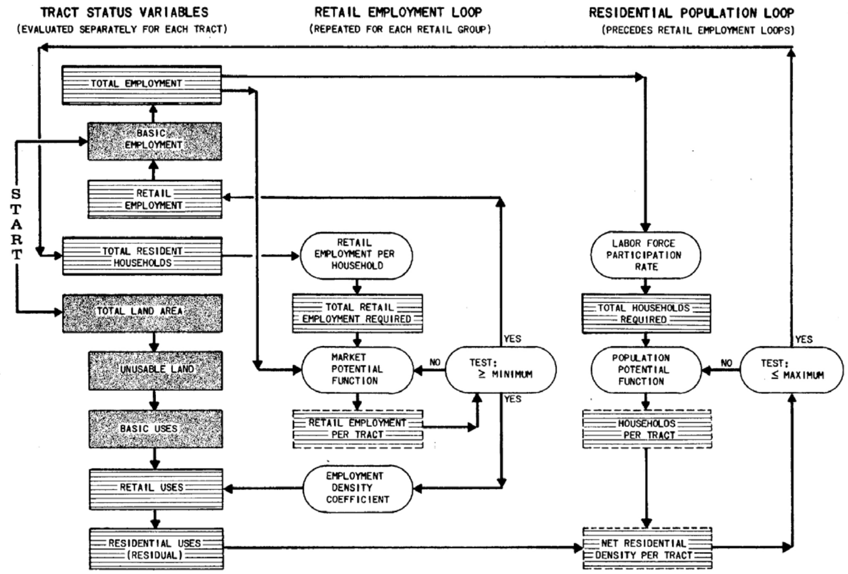


Fig. 1 — Information Flows in the Pittsburgh Model

The ‘Lowry Model’, an early example of predictive urban simulation, modelled Pittsburgh's economy through causal relations between elements such as taxes, population, and density. Image source: Ira S. Lowry, A Model of Metropolis, 1964, 5.

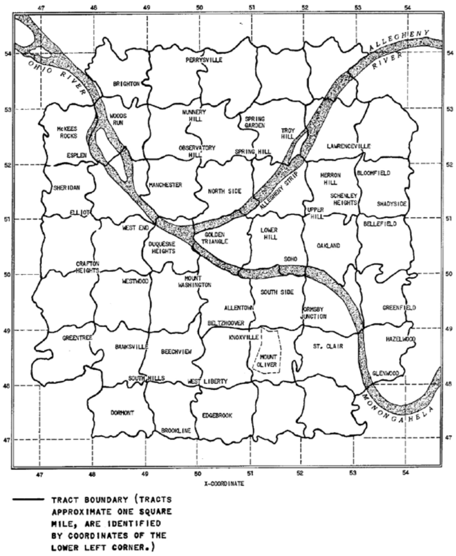


Fig. 13 — Tracts and Place Names in the Metropolitan Core

Pittsburgh city map divided into one-square miles, part of RAND Corporation's 1964 Economic Study of Pittsburgh led by Ira S. Lowry.

Architectural Science in the Steel City

In Pittsburgh in the 1970s, architectural and scientific sensibilities converged in the construction of a computational understanding of the city. The early experiments in computer-aided urban design at the Institute of Physical Planning at Carnegie Mellon University are illustrations of this phenomenon. They indicate a fledgling view of the urban as a computational entity, and of *design* as an overarching, supra-disciplinary concept.

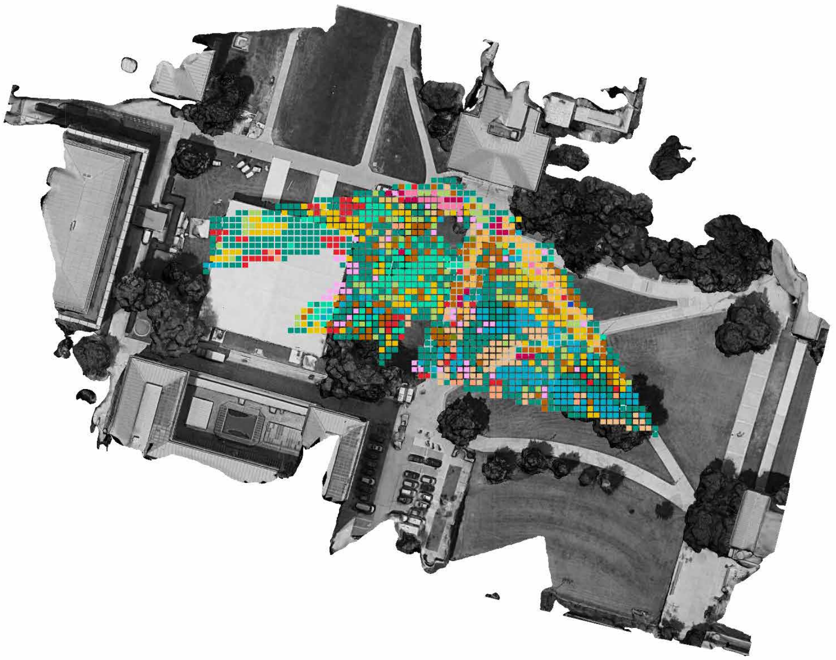
In the late 1960s, when Carnegie Tech and the Mellon Institute of Research merged into a university, a new School of Urban and Public Affairs (SUPA) was created with the mission to 'deal in a scientific manner with problems of the public sector' and help build the 'civil-industrial complex.' Funded by gifts from the Richard King Mellon Trusts and the Aluminum Co. of America, this school sought to bring together disciplines such as political science, anthropology, sociology, and urban planning to address issues of public administration and – crucially – urban renewal. The Institute for Physical Planning (IPP) was one of three research centres started within the school under the leadership of the late architect and computer scientist Charles M. Eastman. Members of the IPP worked on surveys and planning research in public housing studies, but they soon began to focus on loftier ambitions related to the application of computing to architectural and urban representation and 'problem solving'. We may see the IPP as a disciplinary intervention designed to transform architectural and urban disciplines through computation, supported by a new curriculum and by the establishment of a doctoral programme 'to promote more rigorous methods in architecture'. The IPP was thus aligned with the intellectual makeup and industrialist ethos of the newborn university.

Patient zero of this experiment in architectural scientism was Charles Eastman's Ph.D. student Christos Yessios, whose 1973 dissertation was co-advised by prominent computer scientist and early AI researcher Alan Newell and supported by NSF funding for 'the development of formulations and algorithms for spatial arrangement problems and the analysis of hierarchical problem solving'. Yessios formulated one of the earliest examples of computer-aided urban design, CISP, a problem-oriented programming language for site planning built on FORTRAN. Referencing Chomsky's 'generative grammars', Alexander's 'pattern languages', and more immediate ideas about AI and design as problem solving techniques developed at CMU by Newell and Herbert Simon, Yessios followed a 'linguistic model' for computer-aided site planning that, on the one hand, specified a repertoire of units and, on the other, established rules for their computability. CISP, which was never implemented, allowed users to specify a repertoire of units for site planning and establish constraints such as views or access points. Using a backtracking algorithm, the system iterates through alternative placements of the units until it finds a solution that satisfies the constraints.

If software systems can be seen as artefacts embodying theoretical commitments about the practices they are meant to support, CISP was the opening salvo of a computational theory of urban design. The types of operations enabled by CISP are greatly simplified versions of even the most elemental of urban design operations. And yet, the translational work they performed between computation and urban design – the inscription of design as a series of machine operations – made CISP a legitimate expression of what was to become a dominant mode of knowledge production. Aligned with contemporary AI discourse, its operative logic construed design as an algorithmic 'search' through a combinatorial space governed by rules and constraints. Experiments like CISP were expressions of a colonising impulse typical of computer cultures. While thematically linked to urban concerns, the view of architectural and urban design that emerged was more in line with information processing discourses than with Pittsburgh's specific urban challenges. These are, perhaps, the perks of abstraction.

In this context, the word 'design' also started to gain a new meaning as a kind of general problem solving which, when formalised mathematically, could exist anew in the symbolic worlds of software. Here, architecture and the city were understood as a special instance of a larger category of 'physical systems'. In this new arena, data structures and building structures were parallel means of constructing – a rhetorical alignment which was central to the work of the group. These researchers' theoretical frameworks (AI, cognitive science and psychology), and methodological inclinations (protocol analysis and computer language building) equated humans and computers as cognitive, symbol-crunching machines.

Meanwhile – and foreshadowing present-day 'smart-city' discourses – the city started to appear as an information processing machine.[8]



8 See, for example, Charles M. Eastman, "On the Analysis of Intuitive Design Problems," *Institute of Physical Planning* (Pittsburgh, PA: Carnegie Mellon University, 2 June 1968), http://doi.library.cmu.edu/10.1184/pmc/newell/box00033/fld02247/bd10001/doc0001. Charles M. Eastman, "Cognitive Processes and Ill Defined Problems," Institute of Physical Planning (Pittsburgh, PA: Carnegie Mellon University, 15 September 1969), http://doi.library.cmu.edu/10.1184/pmc/newell/box00032/fld02219/bd10001/doc0001.

Imagining Other Platforms

The previous vignettes, which are elements of a broader research project, explored Pittsburgh as one site where the confluence of technical expertise in computation, public policy, and architectural research helped configure present day understandings of the city as software. As we saw, notions of design and of the city were renegotiated in computational terms, and new architectural identities emerged that sought to disrupt the discipline through quantitative and computational logics.

Where does this history leave us? Can we imagine urban technologies in ways that refuse, or at least critically acknowledge, the complicated legacies of these systems in military-academic industrialism and managerialism? Can new urban technologies be designed with present day computational methods such as machine learning, computer-vision, and sensing in ways that eschew commitments to surveillance-capitalist logics? And, I repeat, what can architectural modes of inquiry do to illuminate, challenge, or subvert these logics?

The following paragraphs briefly describe a few recent projects that explore these questions through the design of inquisitive urban technologies. They are not meant to offer conclusive answers. Instead, they each help articulate an important question concerning urban platforms.

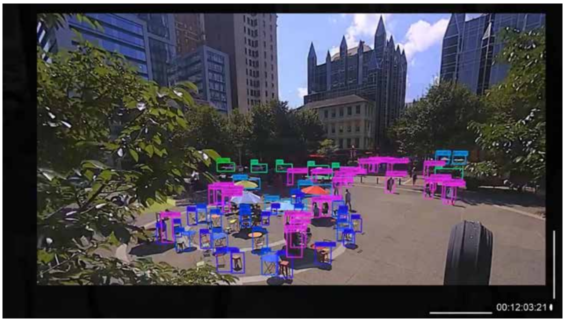
Tracing urban life

Can digital platforms for urban analysis challenge revenue and police-centred applications and engender engaged data publics able to consciously participate and critically intervene in evolving portraits of urban life?

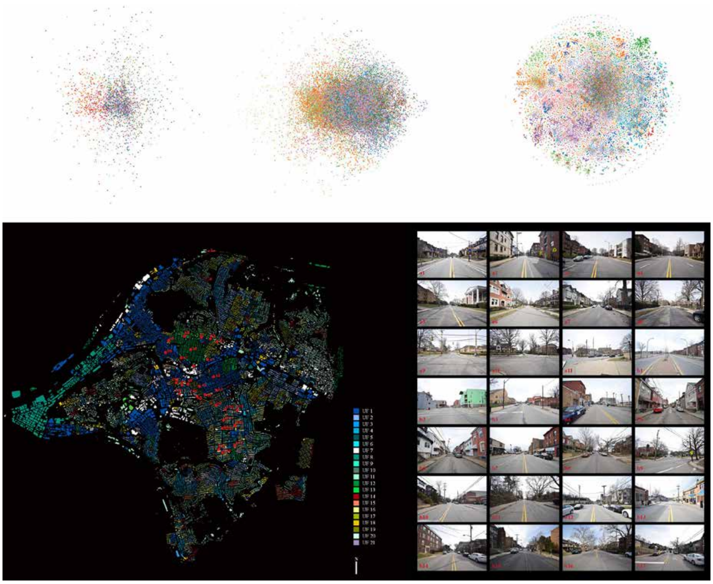
The WYSIWYG project combines spatial analysis methods with recent developments in data science, machine learning, and computer vision to understand how urban spaces give structure to human activity. It reimagines computationally William Whyte's study of 'The Social Life of Small Urban Spaces', which used film, qualitative observations, and clever counting and mapping techniques to gain a better understanding of public spaces in cities across the United States.[9] The project, led by Javier Argota Sánchez-Vaquerizo, was supported by the Metro 21 Institute and the Pittsburgh Downtown Partnership, studied Pittsburgh's emblematic Market Square, and resulted in a visual-data portrait of its urban activity. This portrait combined computational analyses and on-the-ground observations, and was both anonymous and deeply local. In contrast with the Lowry models of yore, this was not a predictive tool but an interpretive, and open-ended one. It helped trace fluctuations in the use of urban space in response to weather changes and to the disposition of urban furniture, suggesting new ways to study the relationship between built form and urban activity – as well as new questions about data access and literacy.

9 Javier Argota Sánchez-Vaquerizo and Daniel Cardoso Llach, "The Social Life of Small Urban Spaces 2.0: Three Experiments in Computational Urban Studies," in *Computer-Aided Architectural Design. "Hello, Culture,"* ed. Ji-Hyun Lee (Singapore: Springer, 2019), 295–310.

Screenshots. Paisajes distantes is a networked audio-visual performance by Altiplano (Daniel Cardoso Llach & Andres Lombana-Bermudez) linking soundscapes and visuals from Bogota, Colombia, and Pittsburgh, United States during the 2020 COVID-19 lockdowns. It was part of the SoundArt selection at the International Conference of Computational Creativity (ICCC) in 2020. https://youtu.be/UwU3H4uZ17c



Screenshots. Understanding public space use in Pittsburgh's Market Square. Computational Design Laboratory, Carnegie Mellon University School of Architecture 2019. Project led by Javier Argota Sánchez-Vaquerizo advised by Daniel Cardoso Llach, Daragh Byrne, and Molly Wright Steenson. Video download link: https://bit.ly/364zn5T



Understanding morphological variations in a city's fabric through a combination of data-structure design, computational analysis, archival research, and photographic walkthroughs. Project led by Jinmo Rhee at the Computational Design Laboratory, Carnegie Mellon University, 2018.

Rethinking urban form

Can critically-designed data structures and algorithms combine with other forms of interpretive research to enable new kinds of urban analysis that make visible long histories of urban change, and reveal spatial and infrastructural inequities, in a new light?

This project, developed by Jinmo Rhee at the Computational Design Laboratory, used deep learning, a subset of machine learning methods that leverages data representations and neural networks, archival research, and urban walks to shed new light on Pittsburgh's urban fabric. One of the project's outcomes is a novel kind of urban plan of the city that indicates variations in the use of public and private spaces, heights, and density: a high-resolution 'heat map' indicating the city's morphological gradients.[10] In this project, computational methods acted not to replace but rather enrich qualitative forms of observation and analysis. On the ground, through urban walks and through document analysis in the city's historical archives, Jinmo sought to corroborate and enrich the insights produced by his computational analysis. At a technical level this project facilitates a new kind of comparative analysis of urban fabrics within a city and across different cities. At a methodological level, it hints at an enriched toolkit for urban technology design that relies not only on the apparent trustworthiness of urban data but probes and situates these data critically alongside other forms of evidence, analysis, and experience.

Juxtaposing distant landscapes

Can platforms elicit new forms of co-presence that do not rely on production logics but enable unstructured interactions, new modes of creative engagement, and new understandings of the urban?

This project, an artistic collaboration between Andres Lombana Bermudez and myself, is a networked, audiovisual performance that links soundscapes and visuals from the two cities where we live – Pittsburgh and Bogota – captured during the COVID-19 quarantine period of 2020.[11] An exercise in juxtaposition, it places dissimilar sounds and imagery of ferrovial systems, water canals, urban fauna, and domestic life alongside synthetic soundscapes created using guitars, granular synthesis, and other software instruments. We performed part of the piece live using an online networked music performance (NMP) platform, and completed it asynchronously locally in our machines. The resulting piece, *Paisajes distantes*, hinted at the possibilities of new encounters, new forms of co-presence, and new kinds of creative engagement shaped by the necessity of isolation and by the affordances of online platforms and computational processes.

10 Jinmo Rhee, Daniel Cardoso Llach, and Ramesh Krishnamurti, "Context-Rich Urban Analysis Using Machine Learning: A Case Study in Pittsburgh, PA," in The 37th Conference on Education and Research in Computer Aided Architectural Design in Europe, 343–52 (Porto, 2019), https://doi.org/10.5151/proceedings-ecaadesigradi2019_550.

11 Daniel Cardoso Llach, and Andres Lombana-Bermudez. "Altiplano – Paisajes distantes," 2020, https://www.youtube.com/watch?v=UwU3H4uZ17c.

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