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The Knowledge Accident Situating the Built University within the Virtual

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Abstract

The increasing un-sustainability of the built university and the rise of the apparent mass democratization or synchronization of higher education through the virtual Massive Open Online Course [MOOC] is occurring concurrently with the mutation of the historically grounded Accident into the Knowledge Accident. The standardization of higher education through the MOOC has created the conditions for the Knowledge Accident, the “integral accident”, of the built university. This is where we find the present state of the university, in a moment of crisis grounded in unconstrained "progress".

The current form of the MOOC, begun in 2011, has expanded and evolved with such rapidity that the effect cannot be accurately analyzed or observed. It's perceived success is framed solely within its temporality and rapid growth, obscuring the potentially detrimental effect on the built campus. The ‘pedagogical campus and classroom’ is being replaced by the individual screen and the living room; the classroom becomes in effect chair-less. This conflict of temporal vs. real, hierarchical vs. horizontal has created the conditions for the fragmentation of the built university; the accident is unknown.

The evolving theory of the accident becomes a lens through which to assess these the conditions of the present, specifically the increasing vulnerability of higher education and the built university.

The temporal nature of the digital is generating, but also obscuring the detrimental effects on not just the built university, but higher education in general,

shielded behind data generated illusions of progress and success. This theses caters to the virtual MOOC, becoming the design for its built infrastructure while exposing the accident of the virtual: its corrosive effects on meaning and place.

Architects have the ability to preemptively respond.

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Executive Summary

Chapter 0: "The Historian Recounts the Collapse of the Ivory Tower" incorporates the Fall semester thesis preparation work. It looks closely at the historical and social factors that have led to the massification of the traditional built university in the United States. The thesis preparation book traces major shifts in higher education, through the phases of colonialism, nationalism, and globalization. Therefore, the time frame studied is from the founding of the first universities in the United States prior to the Revolutionary War through the present day. Major advances in higher education occurred during these periods. During the phase of nationalism, defined in this thesis book from the founding of the United States through WWII, higher education began to become readily accessible through federal regulation, with the founding of the first public universities. After WWII, the Serviceman's Readjustment Act massively expanded higher education to the mass populace. The book then traces the shift of the massification of the university, both in terms of built space and social factors. These social factors include increases in government funding and spending, rapidly increasing tuition, and increasing enrollment. This thesis argues that these factors have led to an unsustainable future of the traditional built university.

The thesis preparation book also incorporates a brief history of the rise of virtual online education, and how advances in virtual education have occurred concurrently with great advances of technological innovation over time. Eventually these various experiments in technological advancement and higher

education have led to the conditions for the Massive Open Online Course, the MOOC to form. The MOOC allows for higher education to be accessible to millions through the internet from any location with internet access.

The combination of increasing technological advancement and the massification of the built university have created the conditions for what this thesis terms, "the Knowledge Accident". Building on the theory of the accident by Paul Virilio, the "Knowledge Accident" is defined as the unintended consequences of virtual higher education on the built university. In this conceptual thesis, it is theorized that this unsustainable nature of the university will lead to a reconfiguring of the built university as we traditionally know it, in favor of designing the built space and the physical infrastructure around which virtual online education functions. This thesis is an architectural exploration of the Knowledge Accident.

40 sq. ft or 800 servers: Designing the Wasteland of the University is the architectural proposal of the Knowledge Accident. This incorporates the design aspect of the thesis project from the Spring Semester. The design seeks to exploit the fact that higher education no longer needs to exist within the realm of the built, but can instead exist within the virtual cloud. The thesis proposes that a university for six million students can be incorporated utilizing servers within a building footprint of 40 sq. ft, or on 800 networked servers. How then, does architecture respond, and what does the built landscape of higher education look like?

The built framework for the virtual university is centered on Roosevelt Island, historically an architectural testing ground for the city of Manhattan. The project is located next to Cornell University's future Tech Campus south of the Queensboro Bridge. Instead of the traditional classroom and lecture hall, this new university becomes a factory for virtual higher education, building on the historical shift towards the massification of higher education. The design for the thesis becomes a built infrastructure powering a university for six million students. The university does not cater to a student body, or the individual. This project becomes an autonomous university to sustain virtual higher education. It becomes a factory of higher education, powered by 800 servers existing within 40 sq. ft of building. What becomes significant is that so little square footage can sustain that scale of higher education and learning.

The server room serves two functions. The first is to support the computing necessary to support massive virtual online education. The second is to provide the data storage necessary to support a 3-D print factory on Roosevelt Island, tasked with creating and printing individual learning spaces that can be delivered around Manhattan. The design of the 3-D printers recognizes the fact that the traditional built campus is no longer relevant in the age of virtual education that can be deployed on a smart phone or tablet from any location. Therefore, the role of the built campus shifts from defined archipelagos of knowledge within the built landscape, to individual learning spaces that can be located in any location; individual archipelagos of learning.

The spectacle of this design for the built infrastructure of the MOOC becomes the storage tower for the 3-D print material. This becomes the new Ivory Tower for the virtual university. The 3-D print material arrives in plastic pellet form, deposited into a bucket elevator system, which slowly fills up the tower with 3-D print material. This spectacle occurring within the tower is visible from Manhattan. The pellets are then converted to plastic filament and delivered to the large 3-D printers in order to create these individual spaces and classrooms.

The forms created by the 3-D printer become a pastiche of architectural forms extracted from the traditional built university, and tropes within architectural discourse. These forms, 8-12 feet in length and width become the built representation of the new virtual university. The 3-D printed forms play on the potential for the mass production of the built university, by creating and deploying an endless stream of objects to be deployed within the city. The 3-D printed objects are delivered across the East River on an overhead conveyor system that spans the river. This delivery method allows for the mass produced university to achieve a sublime and visual effect on the landscape. The very visible nature of the 3-D printed object's delivery then plays into the desire for instant gratification through the virtual by the individual. The university comes to you.

The narrative of the Knowledge Accident ends with the removal of the 3-D printed object from Manhattan after its use is no longer necessary, emphasizing the temporal nature of virtual higher education. The object is removed, and delivered to the contoured roofscape of the factory, creating a junkyard, or

wasteland of higher education in the removal of the 3-d printed object. The built university in effect becomes a temporal construct dictated by the needs of individual, fed and powered by 40 sq ft or 800 servers.

Chapter 0: The Historian Recounts the Collapse of the Ivory Tower
Summary of Thesis Preparation Research

The state of higher education and the built university is in a moment of crisis grounded in unconstrained progress. As breakthroughs in technological advancement occur, higher education has increasingly been entering the realm of the virtual, in the form of the Massive Open Online Course [MOOC]. It is becoming the next great experiment in the historical lineage of higher education. New and existing primarily in the virtual, the effects of an experiment such as the MOOC are difficult to determine. This thesis seeks to analyze virtual higher education through the theory of the Knowledge Accident, a framework, which, when implemented reveals the effects of the virtual on the built landscape within higher education. The temporal nature of the digital is generating, but also obscuring the detrimental effects on not just the built university, but higher education in general, shielded behind data generated illusions of progress and success. This theses caters to the virtual MOOC, becoming the design for its built infrastructure while exposing the accident of the virtual: its corrosive effects on meaning and place.

Shifts in the pedagogy of the built university have occurred with phases of United States history, colonialism, nationalism and globalization, reaching the point of the bursting of the "higher education bubble" within the United States; its unsustainability and massification. Presently, there are 2,455 for year universities

within the United States, an increase of 2,446 since the founding of the United States.

The period of colonialism (1775-83) saw the University as Elite Institution, inaccessible to all but the wealthy. The period of Nationalism in the United States created the foundations for public institutions of higher education, first proposed by Thomas Jefferson in 1779 through the Bill for the More General Diffusion of Knowledge, implemented in 1862. The bill expressed the need for secular education of the public as the ultimate protection from tyranny, with mass education being funded by the public regardless of wealth or birth. The system became a Jeffersonian meritocracy ideal over a natural wealth-based aristocracy.

Architecturally this system was based on the lecture hall and is integral to the built landscape of today's universities. With government legislation such as the 1862 Morrill Land Act, public universities were formed, funded by the selling of federal land obtained through westward expansion. This would fund the creation of Public Universities through WWI, creating close to seventy Public Universities. During the same time period, the invention of the mass produced textbook and correspondence education was formed in 1840, setting the foundations for the massification and temporal nature of higher education, not dependent on physical location. The invention of the radio and the College of the Air in 1922 saw the first use of a technological medium to spread higher education to a mass audience, where the scale of campus could exist on a national and virtual scale as opposed to the physical and local space of the campus.

Significantly the time period after WWII became the Golden Age of the University, as well as the era of mass production of the university, with mass expansion occurring on multiple fronts, especially through technology. With the 1944 Serviceman's Readjustment Act mass expansion occurred in terms of enrollment and campus growth. Socially, the college degree was increasingly seen as the pathway towards upwards mobility and the American Dream. From 1919 to 1944, higher education funding quadrupled to $2 billion, and enrollment tripled to 2.5 million students. By the end of the Cold War, enrollment would again roughly quadruple to 15 million students (today 20 million). The success of the university was seen politically and nationally as a way win the Cold War.

Today, this nationalism has shifted to a corporate, profit seeking approach to higher education. This era is the ultimate mass production of the university. The degree became increasingly standardized and mass produced, while the campus expanded into one of dormitory sprawl, disintegrating the identity of the individual campus. The rise of stadiums and student services turned the campus significantly into a service industry instead of one focused on academic progress. New companies like the University of Phoenix were founded and exist solely as a transitory university, located within anonymous office parks and the internet, relying on branding for its success. This is a hybrid model, a network of built and virtual. The buildings are anonymous; each location could and is anywhere, and can inhabit any space. This strategy is a precursor to the MOOC , founded in 2008, and completely virtual higher education. The building can be exchanged and replaced with the computer, smart phone and tablet.

The Knowledge Accident draws on a millennia-old evolution of the theory of the accident starting with Aristotle. However, it is the theory of the post-modern accident written about by Paul Virilio that begins to incorporate the era of man-made industrial and technological innovation. The accident becomes the unexpected, unknowable catastrophe of man-made technological innovation and too-rapid advancement. The massification of the accident due to instant and virtual connection and simultaneity is becoming more difficult to prevent or analyze. Innovation is occurring too quickly to be fully understood, and the accident is the unintended consequence of technological progress, shielded in the illusion of its perceived success. This effect is happening to the built landscape of higher education through the MOOC.

With the virtual and the MOOC, concepts of time and distance of the university begins to be eroded, an accelerated temporality, where the accident exists in the virtual, transcending place and boundary. The television, computer and internet has set the stage for mass instantaneous communication and mass-spectacle. The invention of the modern day smart phone in 2001 and the rise of3G and 4G networks have allowed the virtual classroom to be accessible anywhere, in any place. This is the era in which massive virtual higher education is thriving. This shift to the virtual has set a path for a redefinition of “order” within the structure of higher education, from a top down hierarchical approach to a horizontal one where historically based definitions of real, boundaries and power structures are being disintegrated through the temporal nature of the cloud. Specifically in this thesis, the accident is the unintended disintegration of place of

virtual higher education. It represents how knowledge and the built landscape is being diminished by the standardization and synchronization of human activity and thought within the virtual and instant. Immediacy represents progress where success is measured in data and algorithms.

Technologically, it was not until 1950's that education through the television gained mass popularity, as non-traditional distance education in an era of an increasingly mobile population and rising costs of higher education. The rise of cable and 24 hour news channels launched the idea of visual and instant information that would then be seen with the internet. An individual no longer had to be present at a specific time but had the ability to watch ad re-watch at their leisure. This anonymity and lack of structure paved the way for the computer and internet as educational mediums beginning the in the 1980's. With the invention of the personal computer, higher education adapted, incorporating the strategies of experiments in radio and television. The time period marked the speeding up and personalization of higher education tailored to the individual. By 1995 the invention of the internet allowed for the potential of the computer to be rapidly exploited, creating the framework for multiple universities to network and collaborate in creating online educational resources. In 2001, with the invention of the modern smart phone with internet capabilities, the user can now be completely mobile, and virtual education is enrolling millions. The framework for the MOOC encourages the virtual nomadism of the student, the service industry aspect of the built university, and is rapidly filling the void brought by the unsustainability of the traditional university. It is transcending existing regulations

and pedagogies in favor of an independent educational sovereignty, eliminating the university as knowledge giver, regulating its role to a glorified Wikipedia. Authenticity shifts from a hierarchical model of professor to student, to a horizontal and anonymous one, an instant network of peer to peer networks. The erosion of the importance of the actual physical university in favor of the virtual, creates a built framework that supports the internet as an infrastructural framework for learning. Instead of celebrating the lecture lecture hall, physical features that become important are the lines of fiber optic cables between internet exchange points. The individual no longer needs to be physically present. The ivory tower is relegated to one piece of the infrastructure of the internet and MOOC, another point within the scale-less fabric of the digital cloud. The role of the university drastically changes, catering to the illusions of progress of virtual higher education.

The virtual and the MOOC mechanizes higher education, a structure driven solely by a fierce desire for validation through data. Numeric success is shielding the harmful nature of the MOOC. Within the virtual data collection renders critical education obsolete, what was best exemplified nostalgically by the built landscape of the university. A project that “solves” on a local scale the intersection of the built with the virtual framework of the MOOC, in fact exposes the flaws of virtual higher education; the Knowledge Accident. The accident is the design of the built framework for virtual higher education, the mechanization and process driven nature of an industrialized university.

The Knowledge Accident is the fact that a university enrolling 6 million students can be spatially located within an area of 40 sq. ft of server space. With the knowledge the mass produced university can be independent from an architectural identity, this thesis seeks to explore architecture's role in this mechanized landscape and process of higher education and explore the mass production and commercialization of higher education on different scales of production and use.

Chapter 1:

40 sq. ft or 800 servers: Designing the Wasteland of the University.
Drawings and Descriptions.

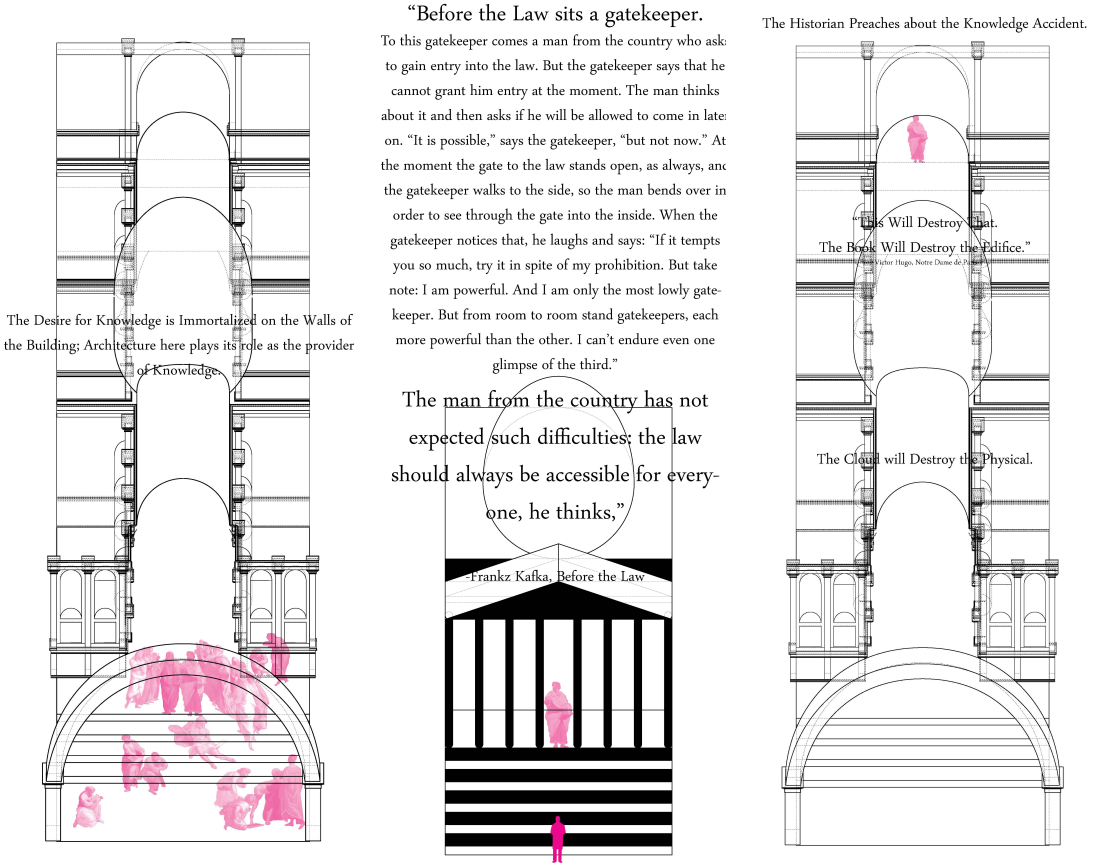


Fig. 1: An axonometric re-interpretation of Raphael's School of Athens. This painting exemplifies the view of the traditional built university and role of educators as "sage on a stage", or an expert expressing his knowledge to eager listeners (left image). With the rise of the massification of the built university, higher education becomes increasingly inaccessible (middle image). The last image is representational of how built space is less relevant to a system of higher education that can exist in the cloud.

All drawings produced by A. Rosenblatt.

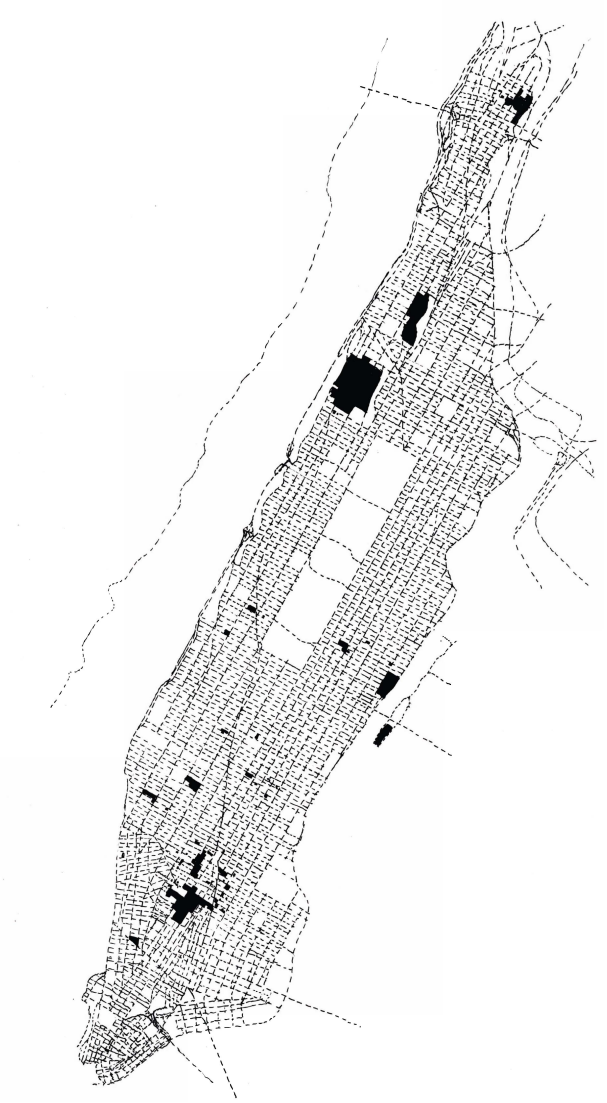


Fig. 2: The Immediate Present: The landscape of the built university within Manhattan. This image shows the built university constrained by the street grid of Manhattan. The black voids are representative of the locations of the built university, or existing archipelagos of knowledge.

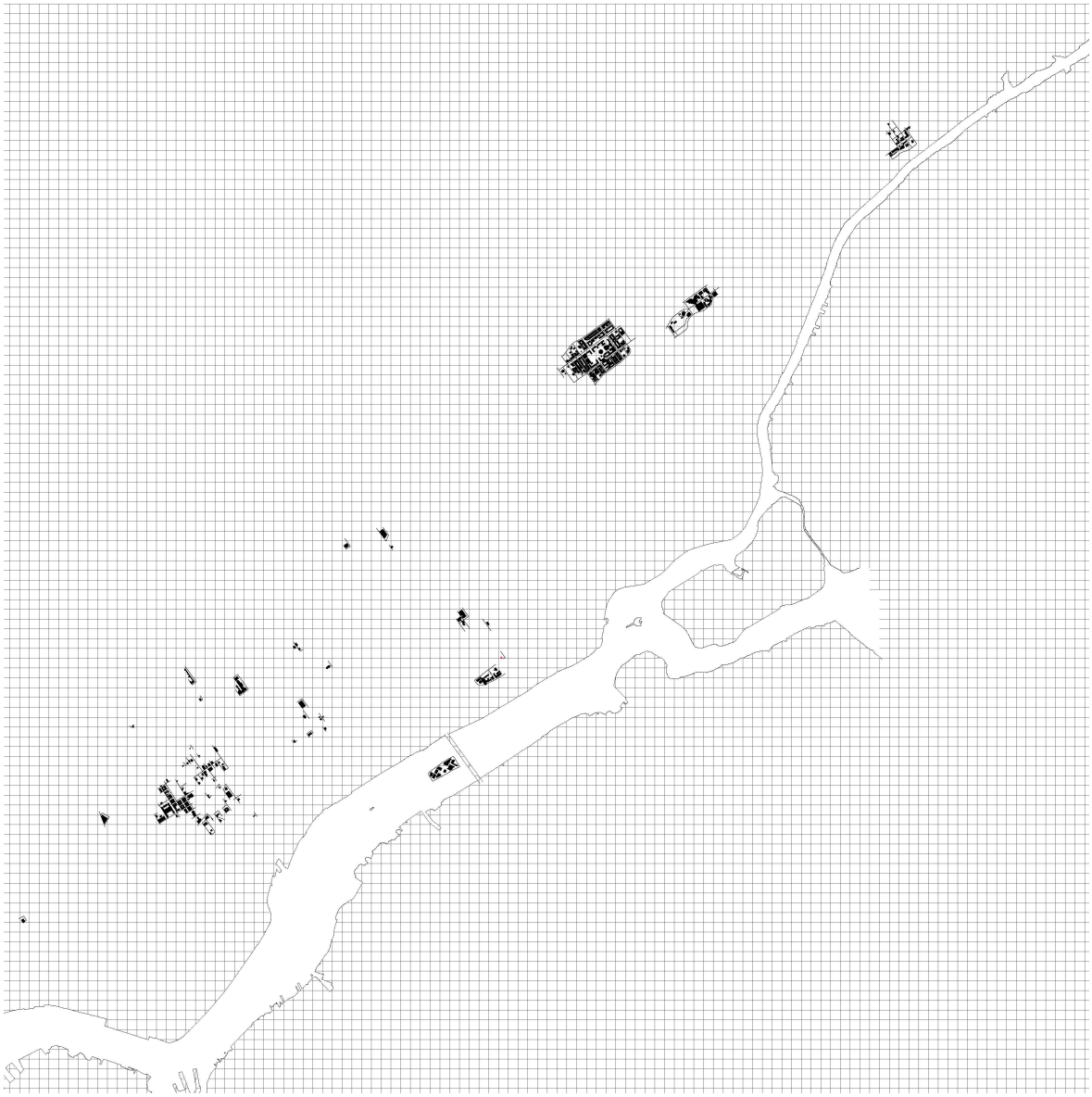


Fig. 3: The erosion of the street grid of Manhattan. With the advent of the digital, geographic boundaries of place become less relevant. The street grid of Manhattan is replaced by a ubiquitous grid, while boundaries of higher education still exist, more pronounced as archipelagos within the landscape.

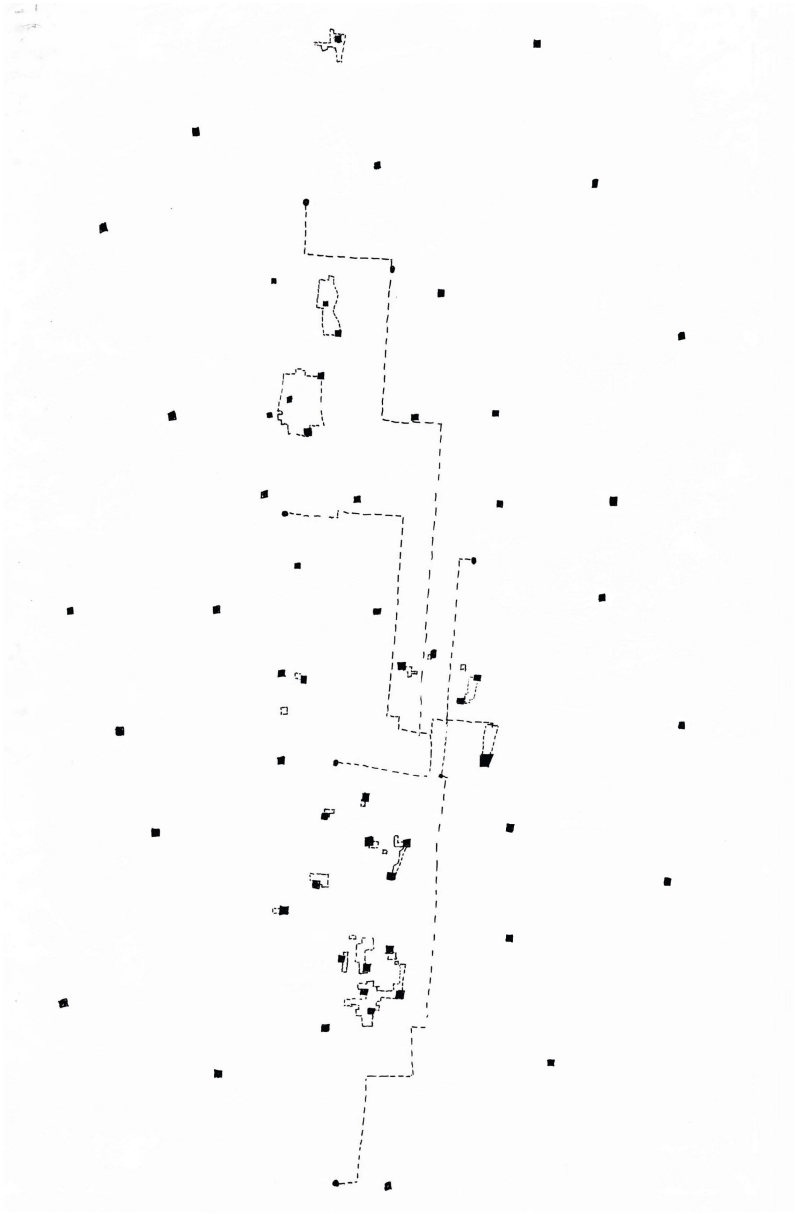


Fig. 4: A representational diagram of the cloud overtaking the built landscape of higher education within Manhattan. The location of the built universities become dotted, and are overlaid with dot and lines representing the fact the individual student is no longer constrained by physical location. The student can become a drifter, learning from a handheld device.

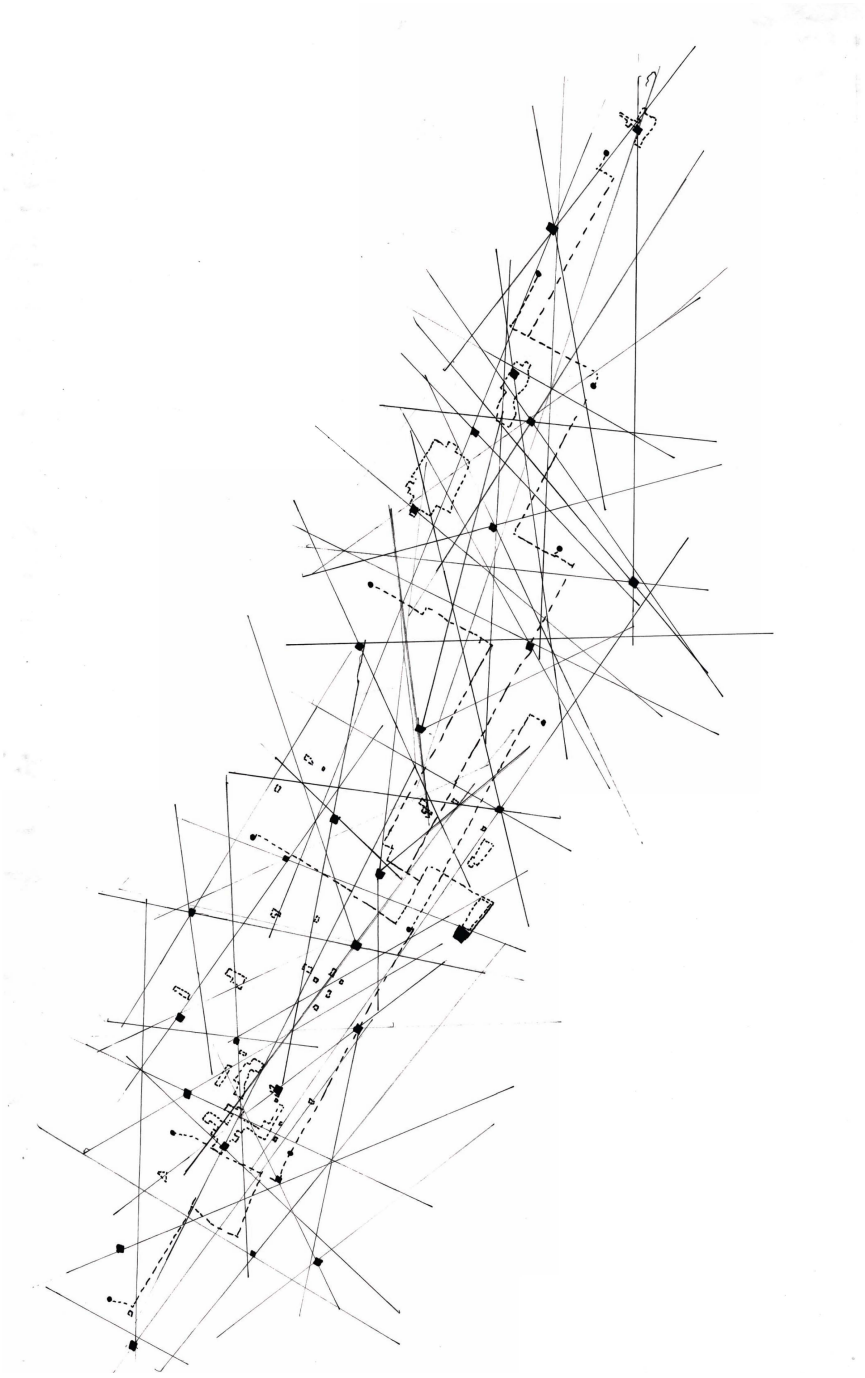


Fig. 5: The continuation of the erosion of physical place. Higher education does not need to be limited to just a geographic area or built space. This diagram represents a rough network of the cloud over the landscape of Manhattan.

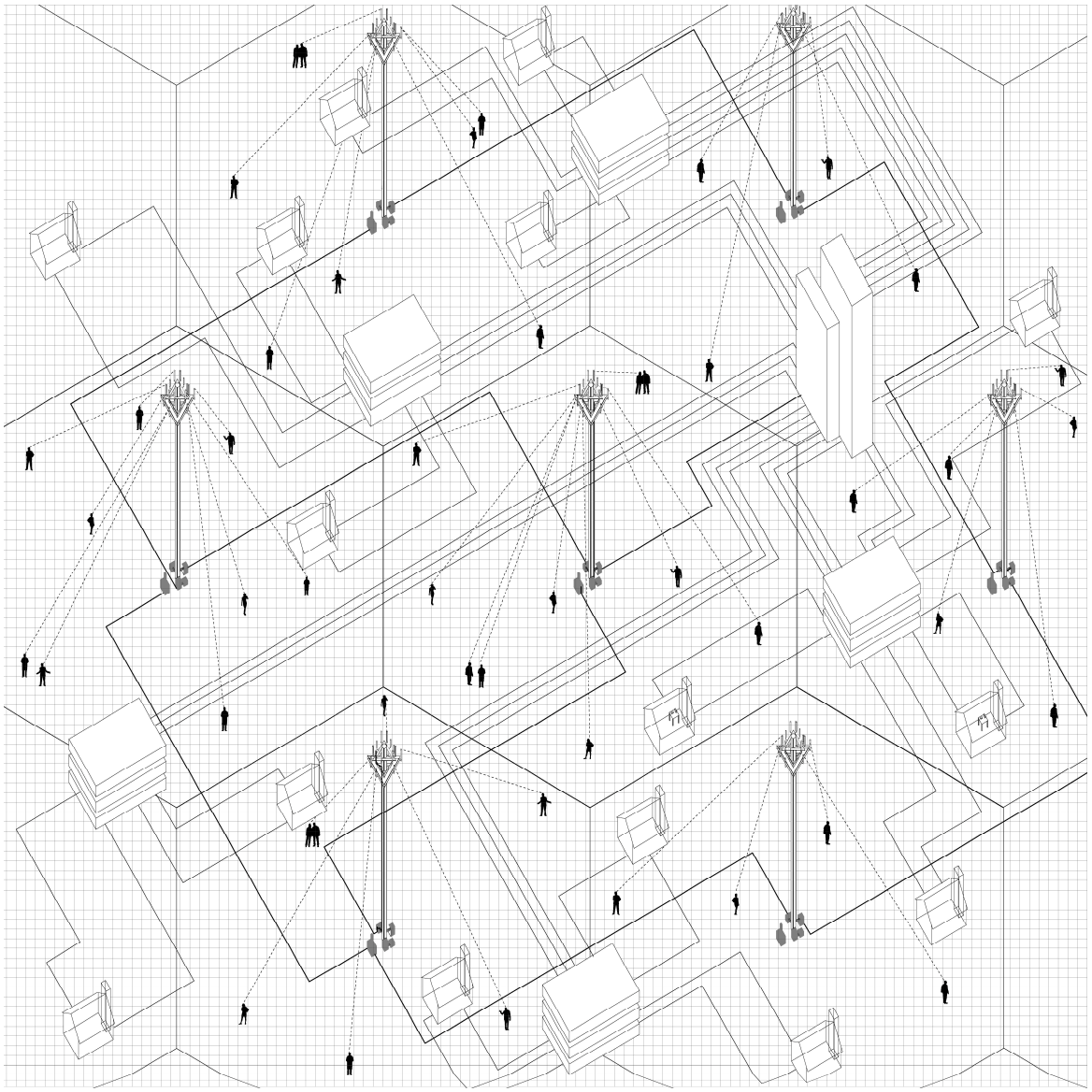


Fig. 6: The network of the digital. While users typically think the cloud exists in the virtual, the internet still has a large physical infrastructure that powers it. A query from a user in fact travels through the 3G network to a wireless access point, router, modem, through fiber optic lines, central offices, and internet exchange points, before the response to the query is sent to the user.

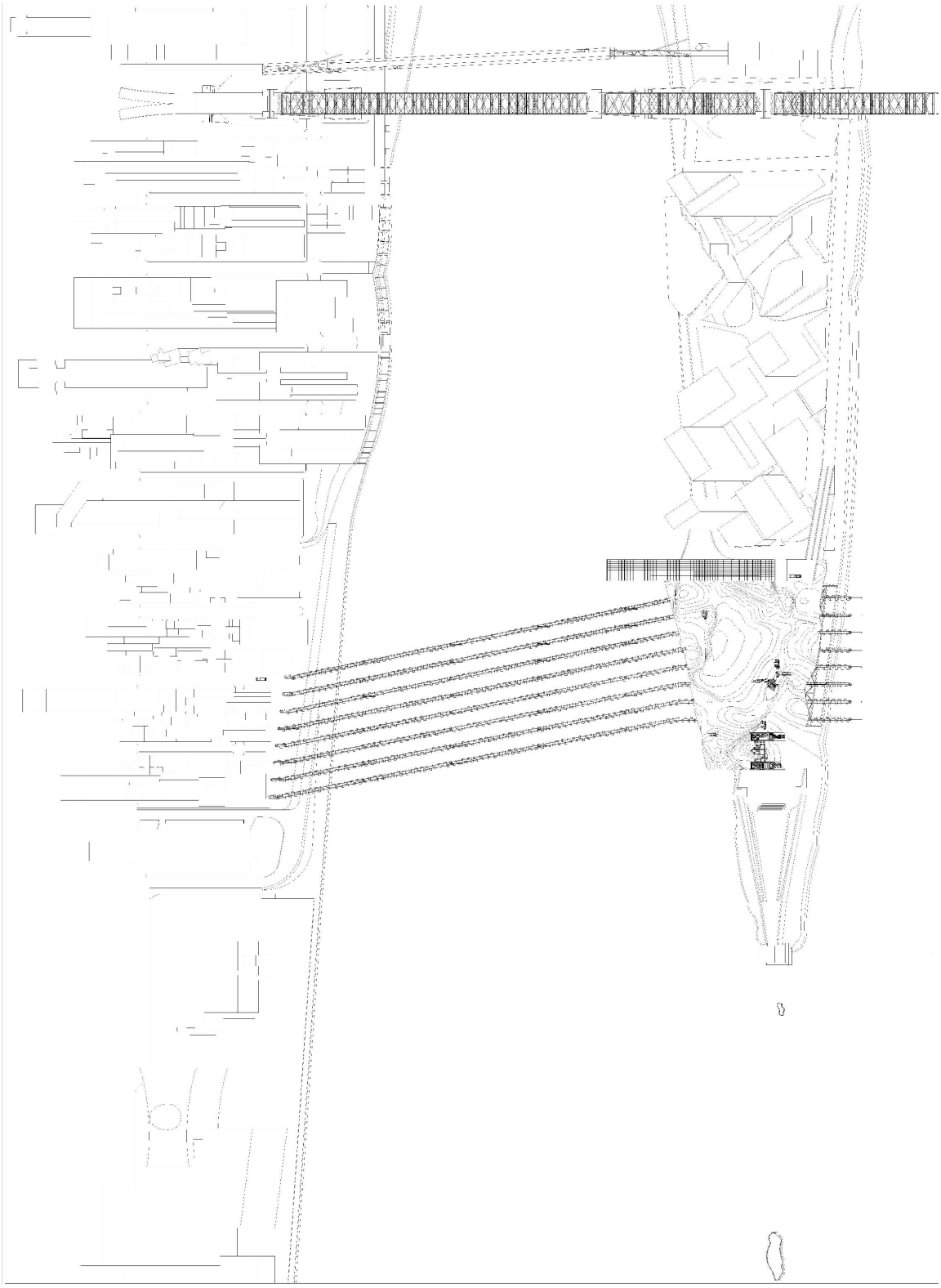


Fig. 7: Aerial Site Plan of Roosevelt Island. Roosevelt Island as the testing ground of architecture for Manhattan. Cornell University's Tech Campus is represented in its future completed state. The design for this thesis is represented adjacent, with the conveyor system spanning the East River to Manhattan.

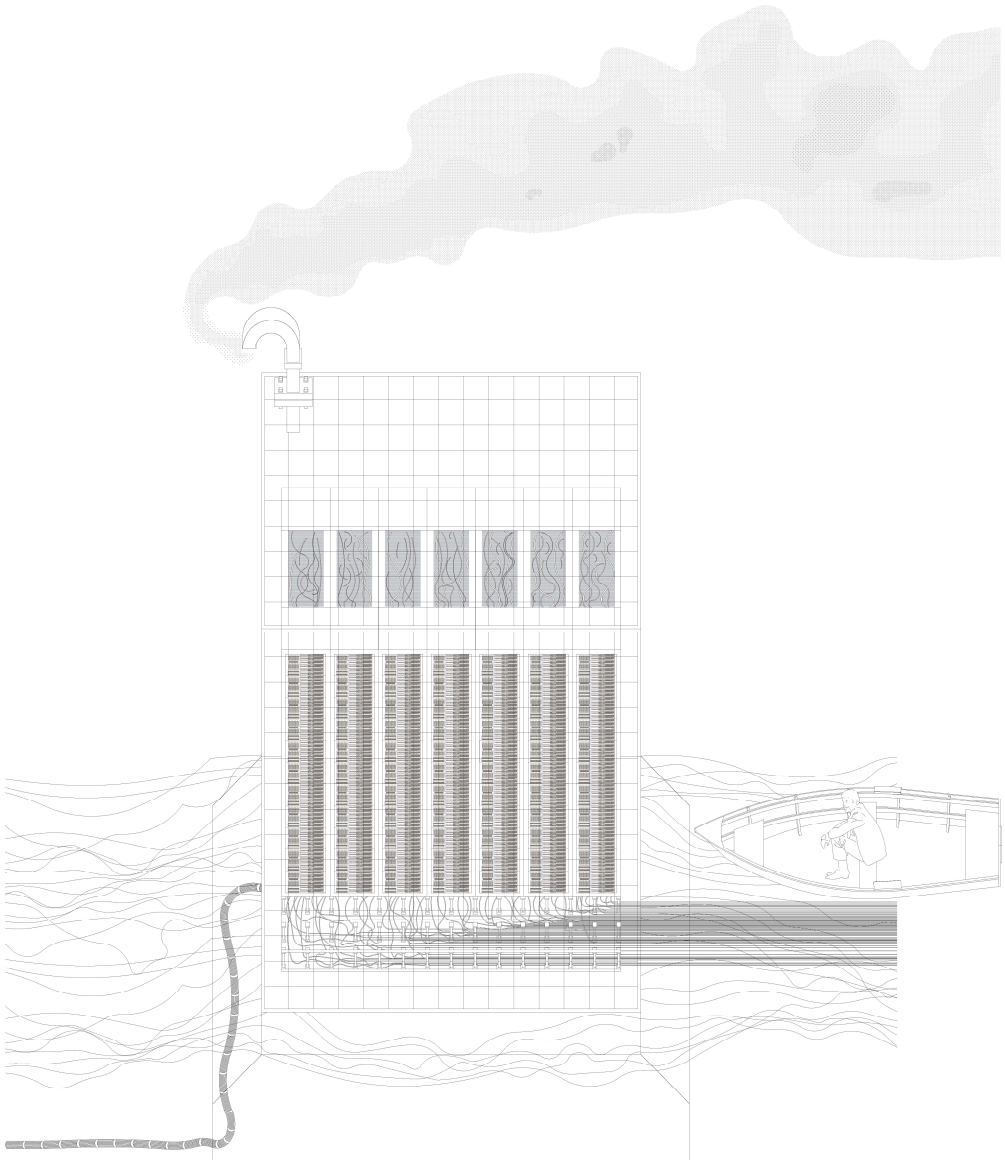


Fig. 8: The Server Room. This 40 sq. ft server room is the powerhouse behind the built infrastructure of the virtual university. Connected to the cloud through fiber optic cables, the server powers the virtual university. The amount of staff necessary to maintain this scale of university is minimal.

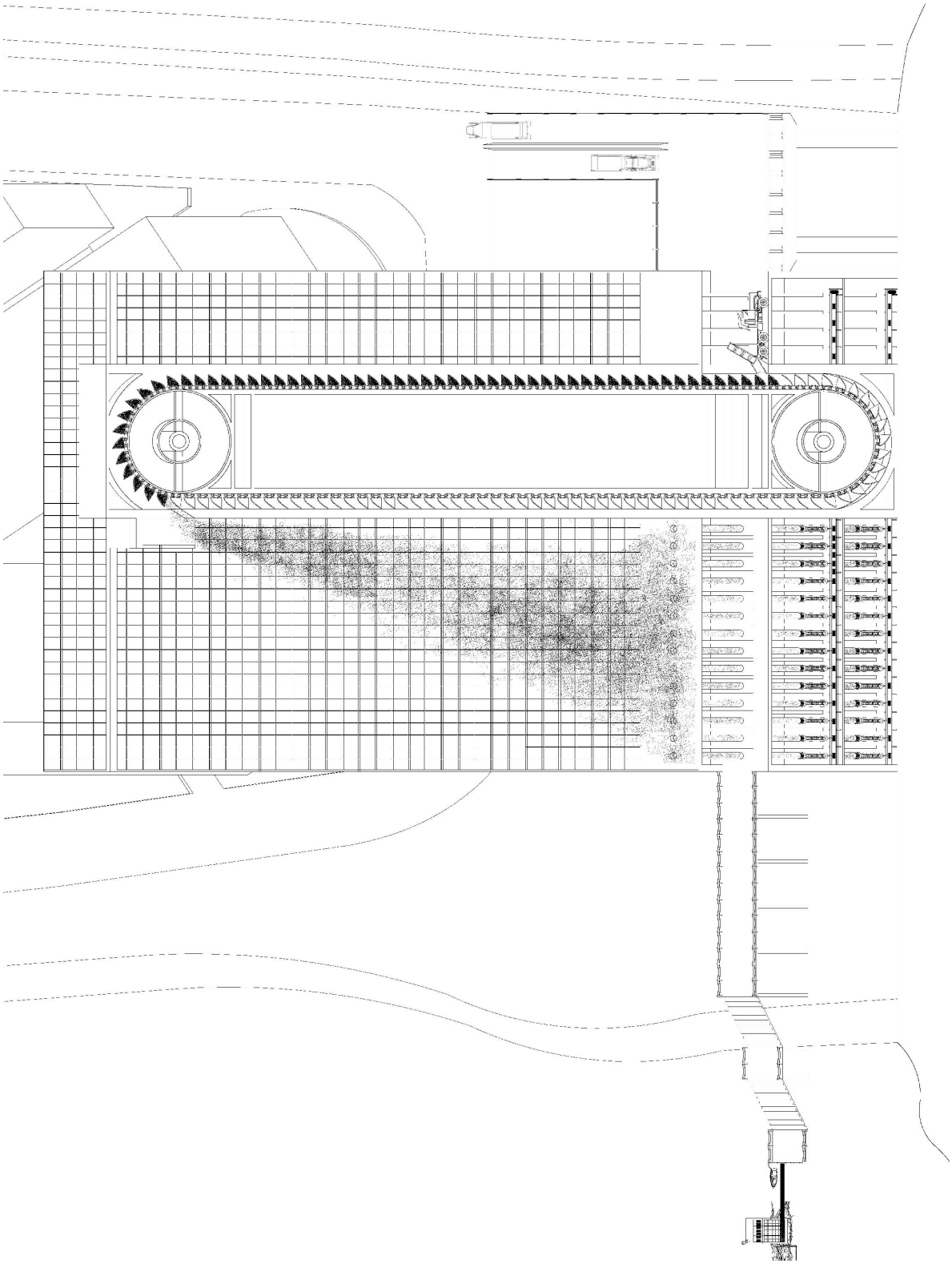
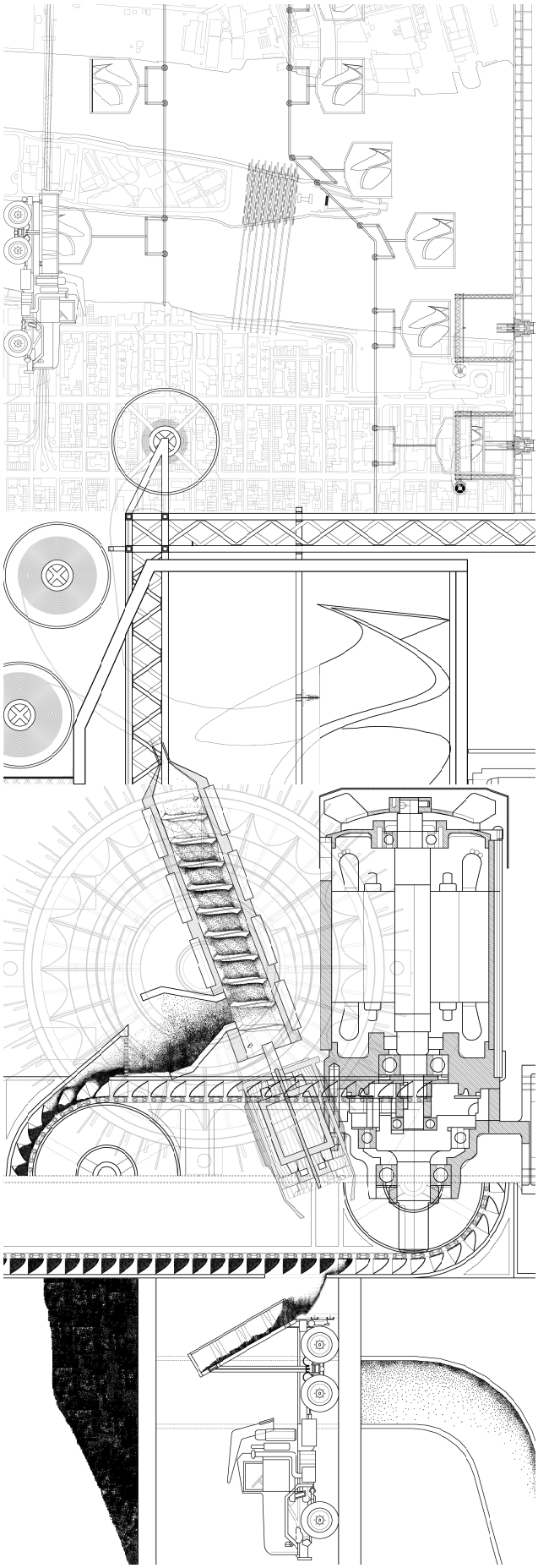


Fig. 9: The New Ivory Tower. This image shows the delivery and storage of the 3-D print material. and its conversion into plastic filament for the 3-D printer. The procession in axis to the server room is also visible. The machine-like aspect of the new Ivory Tower is visible from Manhattan.

Fig. 10: A collage representing the various machines powering the built infrastructure on Roosevelt Island. The system of production is represented from delivery of plastic pellets, conversion to plastic filament, printing of the object on the 3-D printer, to delivery.



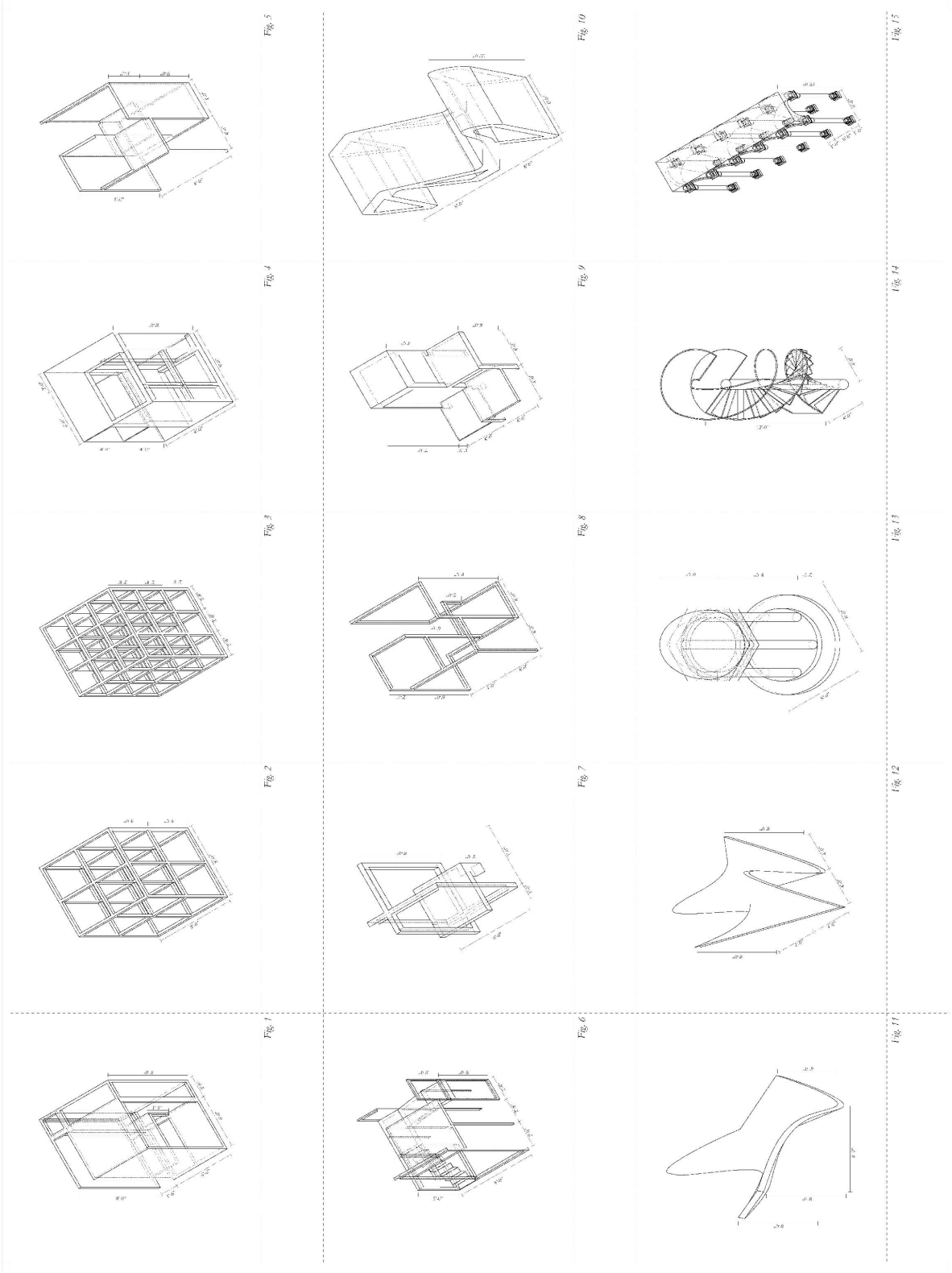


Fig. 11: Examples of 3-D printed objects produced and delivered as built landmarks and individual learning spaces of the virtual university.

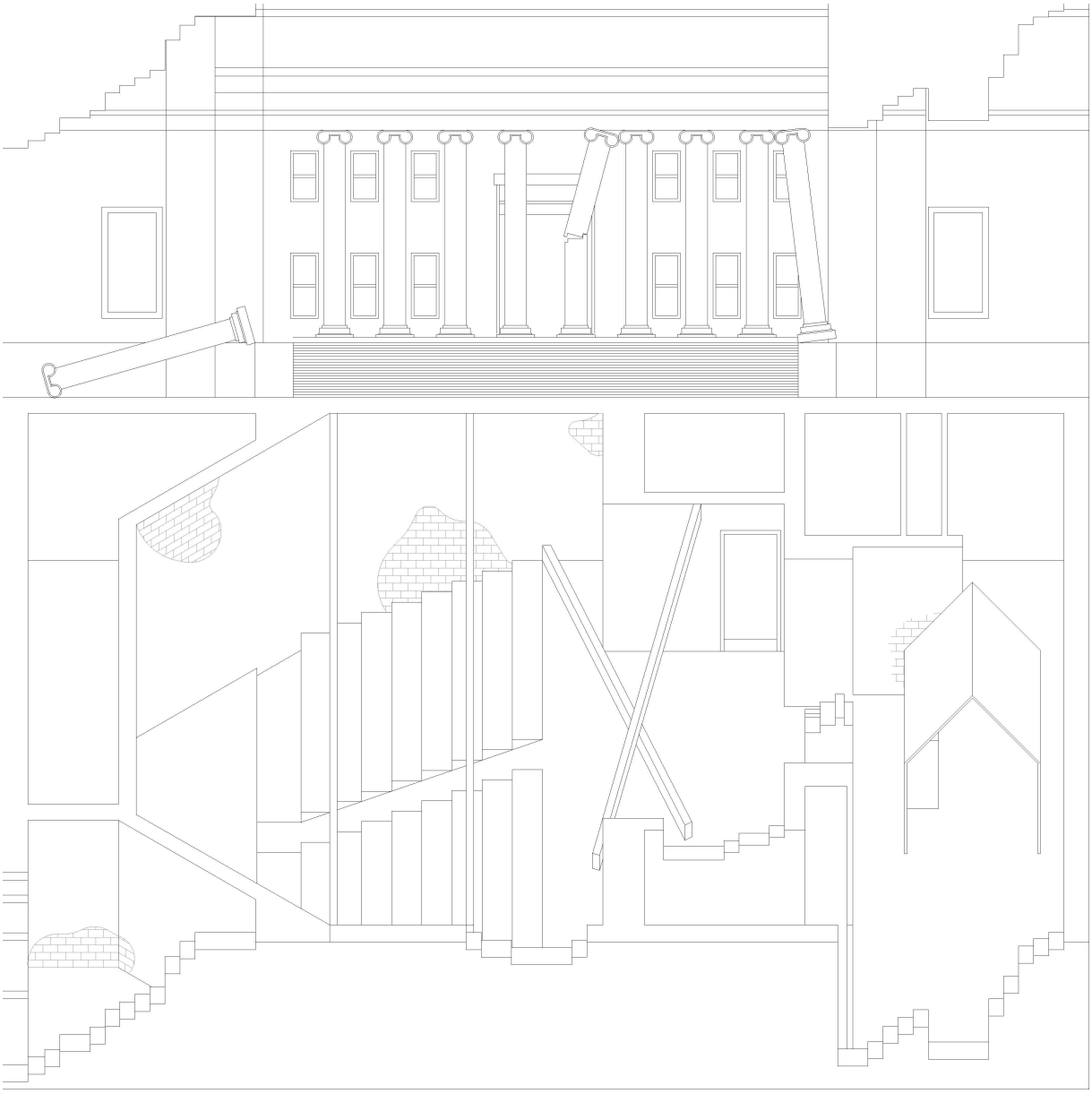


Fig. 12: Site location where the 3-D printed object could be located within Manhattan. This vignette shows the 3-D printed object located within the abandoned ruin of Columbia University, projecting that virtual online education will replace the built landscape of the university.

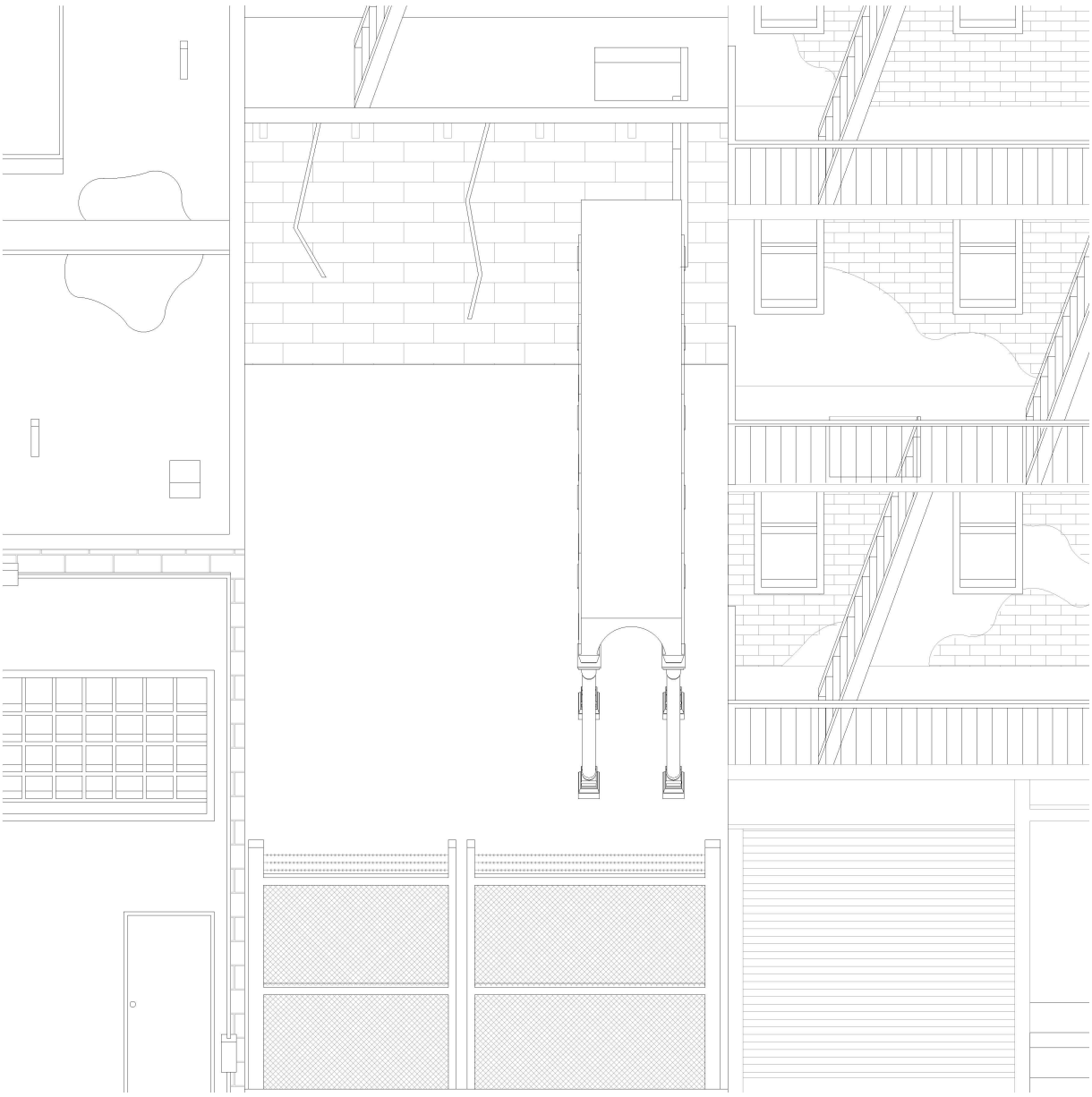


Fig. 13: Site location where the 3-D printed object could be located within Manhattan. This vignette shows the 3-D printed object located within an alley in Manhattan.

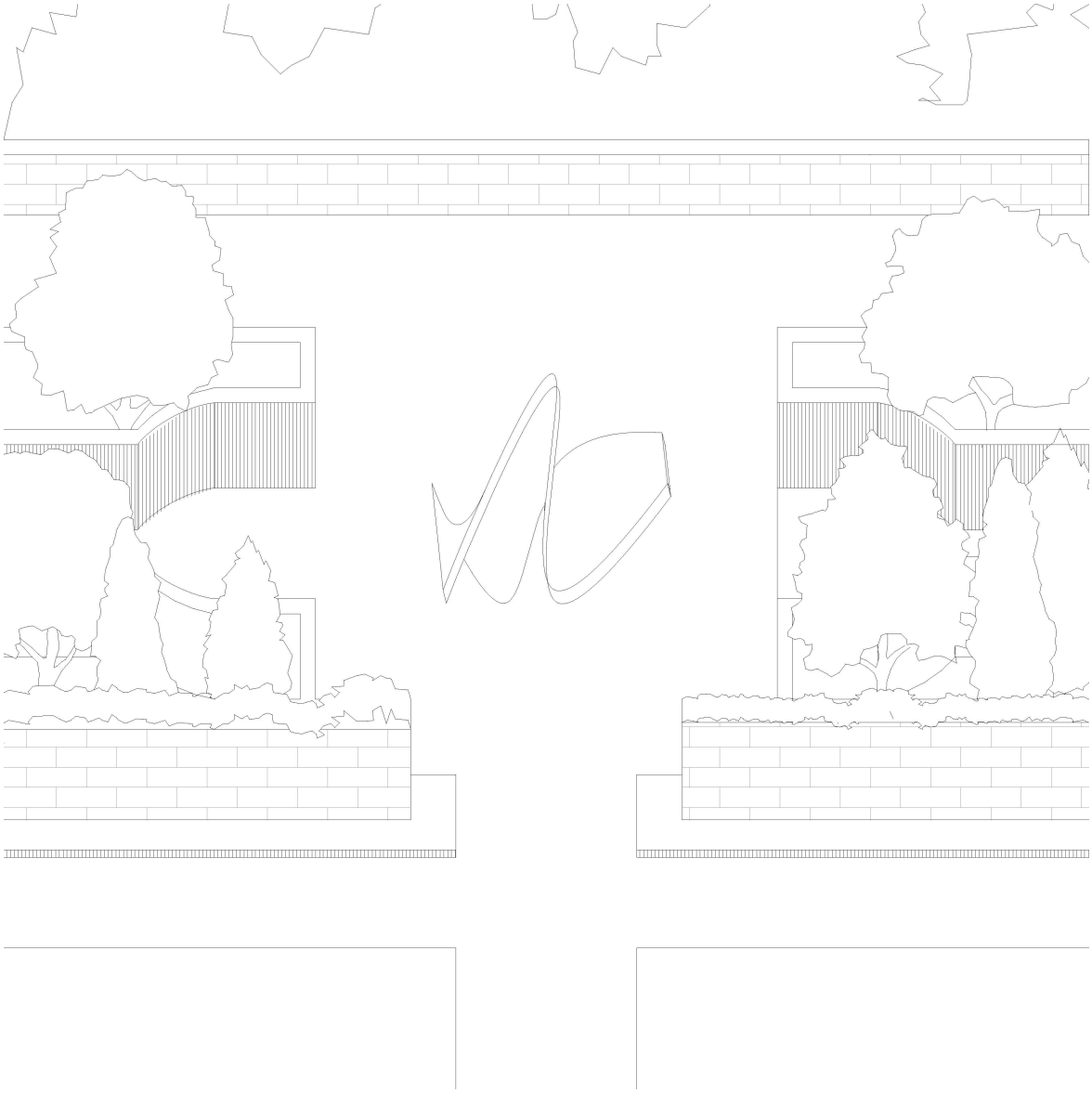


Fig. 14: Site location where the 3-D printed object could be located within Manhattan. This vignette shows the 3-D printed object located within a formal garden.

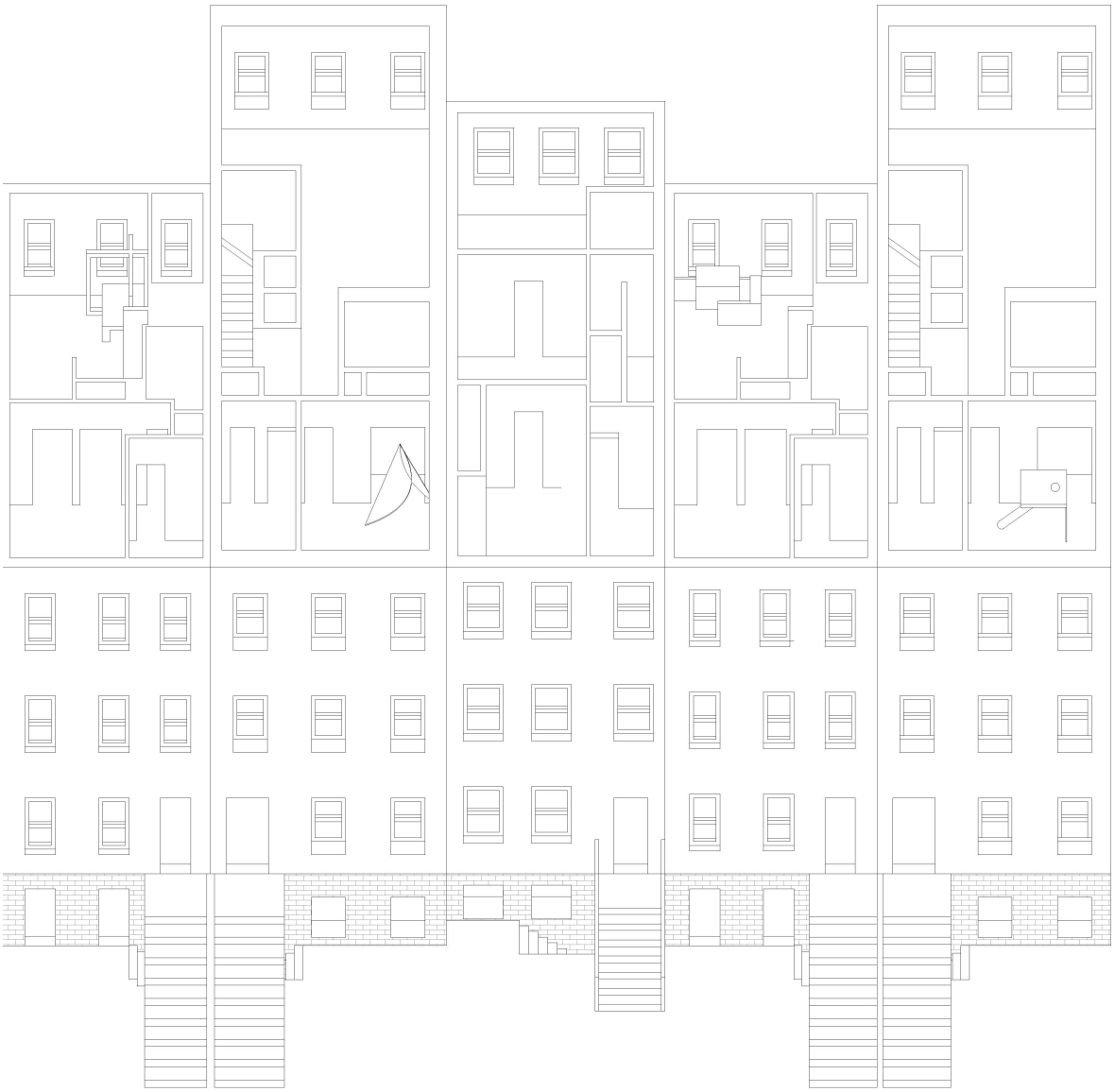


Fig. 15: Site location where the 3-D printed object could be located within Manhattan. This vignette shows the 3-D printed object located within various brownstones and apartments. This image reflects the idea that virtual higher education and learning can take place within the home, and is not dependent on the space of the traditional built university.

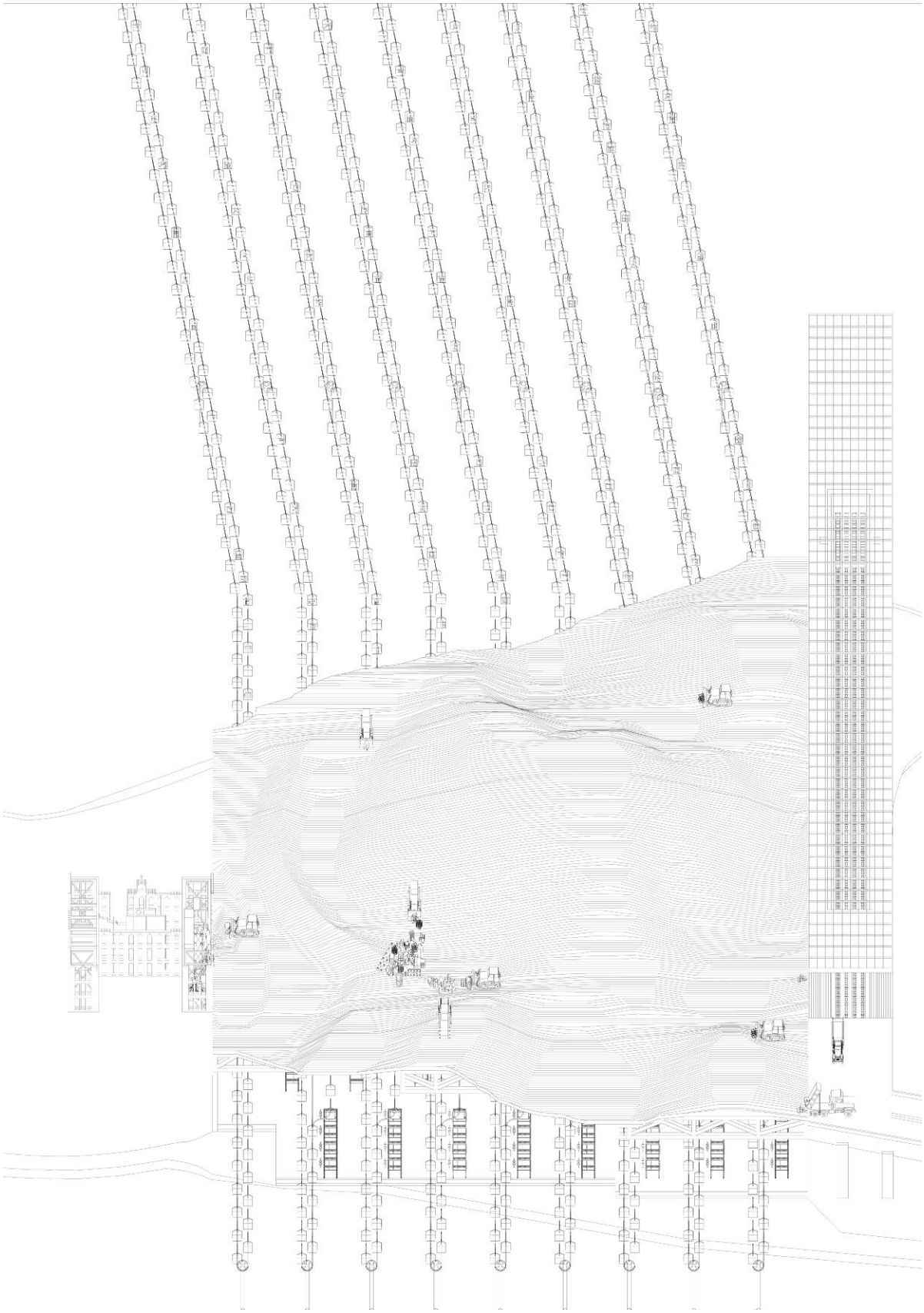


Fig. 16: The return of the 3-D printed objects to Roosevelt Island. The objects are returned to the contoured landscape above the 3-D print factory. This landscape of unneeded objects emphasizes the spectacle of the mass produced nature of virtual higher education.

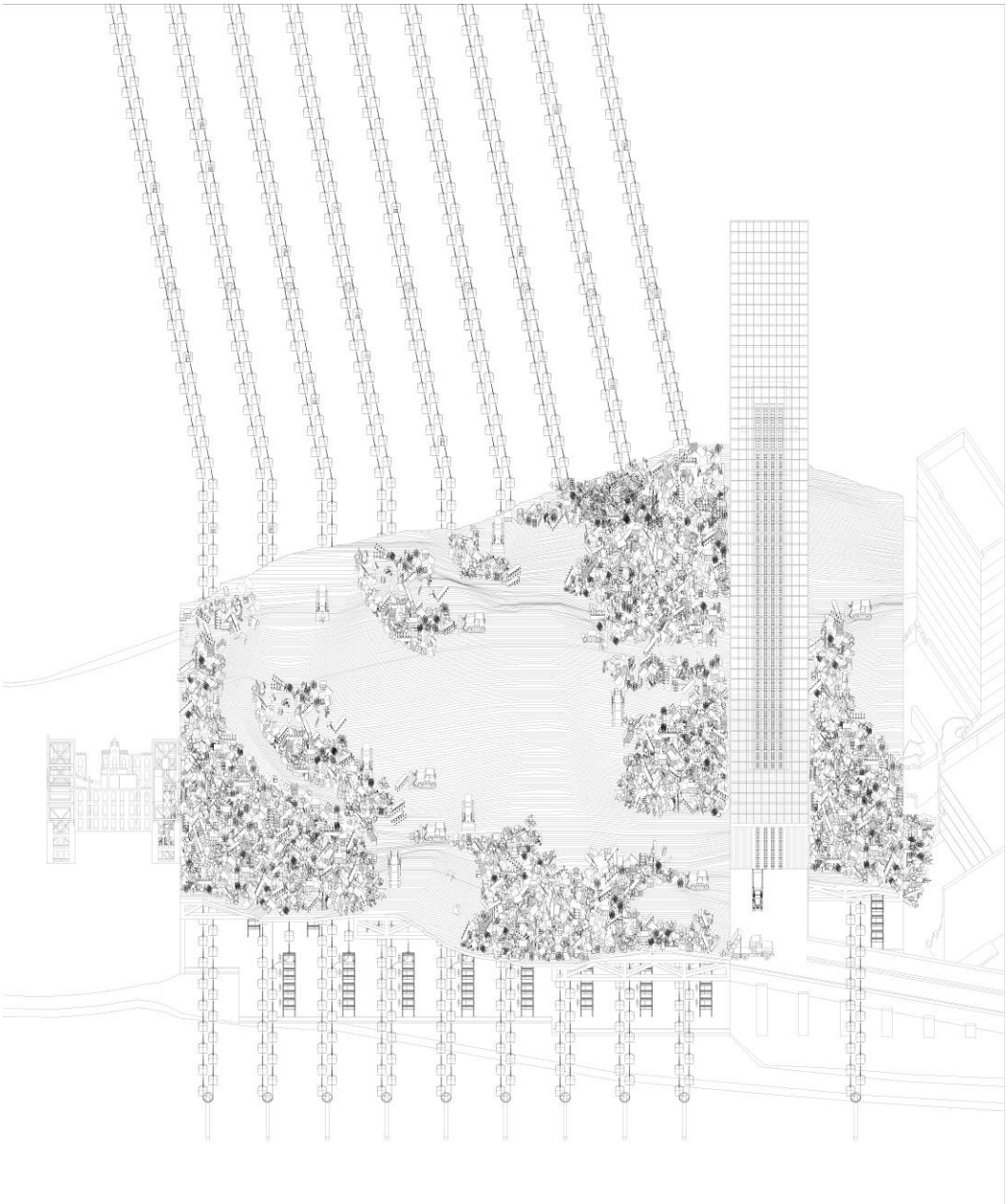


Fig. 17: The wasteland of higher education. The landscape above continues to be filled with returned 3-D printed objects. A continuous process of return even as the 3-D print factory expands across Roosevelt Island.

Works Cited: Thesis Prep Book

1. "E-mails show U-Va. board leaders planning Teresa Sullivan's exit," last modified June 20, 2012, http://www.washingtonpost.com/blogs/college-inc/post/e-mails-show-u-va-board-leaders-planning-teresa-sullivans-exit/2012/06/19/gJQAAytGpV_blog.html.
2. "U-Va. reinstated Teresa Sullivan after weeks of protests," last modified June 26, 2012, http://www.washingtonpost.com/local/students-protest-university-presidents-ouster/2012/06/18/gJQA3GCNmV_gallery.html#photo=1.
3. Paul Virilio, *The Original* Accident (Malden: Polity Press, 2007), 87.
4. "Aristotle," last modified 2012, http://www3.nd.edu/~afreddos/courses/301/aristotl.htm.
5. Virilio, *Original Accident*, 5.
6. Virilio, *Original* Accident, 10.
7. Virilio, *Original Accident,* 7.
8. Virilio, *Original Accident,* 5.
9. "The Cloud, the State, and the Stack: Metahaven in Conversation with Benjamin Bratton," last modified 2013, http://mthvn.tumblr.com/post/38098461078/thecloudthestateandthestack.
10. Benjamin Bratton, "On the Nomos of the Cloud: The Stack, Deep Address, Integral Geography," last modified February 1, 2012, http://www.bratton.info/projects/talks/on-the-nomos-of-the-cloud-the-stack-deep-address-integral-geography/.
11. Bratton, "On the Nomos of the Cloud".
12. Bratton, "On the Nomos of the Cloud".
13. Virilio, *Original* Accident, 6.
14. Bratton, "On the Nomos of the Cloud".
15. Virilio, *Original Accident*, 50.
16. Paul Virilio, *Unknown* Quantity (New York: Thames and Hudson, 2003), 111.
17. Fuller, *On Education*, 48.
18. Virilio, *Original Accident,* 5.
19. Fuller, *On Education*, 48.
20. Langdon Winner, "The Automated Professor Machine," last modified 2011, http://www.youtube.com/watch?v=vYOZVdpdmws.
21. Fuller, *On Education*, 47.
22. Susan Matt, "Before MOOCs, Colleges of the Air," last modified April 23, 2013, http://chronicle.com/blogs/conversation/2013/04/23/before-moocs-colleges-of-the-air/?cid=at&utm_source=at&utm_medium=en.
23. Before Moocs, Colleges of the Air.

24. Before Moocs, Colleges of the Air.
25. Bizhan Nasseh, "A Brief History of Distance Education," last modified 1997, http://www.seniornet.org/edu/art/history.html.
26. Seymour Papert, "Trying to Predict the Future, Popular Computing" 1984. http://shanta.edublogs.org/2006/01/04/the-computer-will-blow-up-the-school/.
27. "California Virtual University," last modified August 14, 2009, http://www.virtualcampuses.eu/index.php/California_Virtual_University
28. Winner, Automated Professor Machine.
29. Fuller, *On Education*, 83.
30. "Designing Geopolitics 2," last modified June 2, 2012, http://designgeopolitics.org/dgp2012/.
31. Metahaven, "The Cloud, the State, and the Stack: Metahaven in Conversation with Benjamin Bratton".
32. Bratton, "On the Nomos of the Cloud".
33. Bratton, "On the Nomos of the Cloud".
34. Metahaven, "The Cloud, the State, and the Stack: Metahaven in Conversation with Benjamin Bratton".
35. Mary Bart, "More than Six Million Students Learning Online, Study Finds," last modified December 2, 2011, http://www.facultyfocus.com/articles/edtech-news-and-trends/more-than-6-million-students-learning-online-study-finds/.
36. Daphne Koller, "Retention and Intention in Massive Open Online Courses: In Depth," last modified June 3, 2013, http://www.educause.edu/ero/article/retention-and-intention-massive-open-online-courses-depth-0.
37. Steve Kolowich, "How will Moocs Make Money?" last modified June 11, 2012, http://www.insidehighered.com/news/2012/06/11/experts-speculate-possible-business-models-mooc-providers.
38. Tamar Lewin, "U.S. Teams Up With Operator of Online Courses to Plan a Global Network," last modified October 31, 2013, http://www.nytimes.com/2013/11/01/education/us-plans-global-network-of-free-online-courses.html?hp&_r=2&.
39. "The Coursera Community," last modified 2013, https://www.coursera.org/about/community.
40. Daphne Koller, "What We're Learning from On-line Education," last modified June 2012, http://www.ted.com/talks/daphne_koller_what_we_re_learning_from_online_education.html.
41. Koller, "What We're Learning from On-line Education".

42. College Board College Search, last modified 2012, https://bigfuture.collegeboard.org/college-search?navid=gh-cs.
43. "Digest of Education Statistics 2010," last modified 2011, http://nces.ed.gov/pubs2011/2011015.pdf.
44. "Clayton Christensen," last modified 2013, http://www.thinkers50.com/biographies/clayton-christensen/.
45. Anna Berkes, "A Bill for the More General Diffusion of Knowledge," last modified 2009, http://www.monticello.org/site/research-and-collections/bill-more-general-diffusion-knowledge.
46. "Morrill Act (1862)," last modified 1995, http://www.ourdocuments.gov/doc.php?flash=true&doc=33.
47. "Serviceman's Readjustment Act (1944)," last modified December 3, 2013, http://www.usnews.com/usnews/documents/docpages/document_page76.htm.
48. National Center for Education Statistics, "120 years of American Education: A Statistical Portrait," last modified January 1993, http://nces.ed.gov/pubs93/93442.pdf.
49. Emily Hanford, "The Story of the University of Phoenix," last modified 2013, http://americanradioworks.publicradio.org/features/tomorrows-college/phoenix/story-of-university-of-phoenix.html.
50. "Costs to Attend University of Phoenix Online Campus," last modified 2013, http://www.collegecalc.org/colleges/arizona/university-of-phoenix-online-campus/#.Up472MTDxXA.
51. Mary Marklein, "College Default Rates Higher than Grad Rates," last modified July 2, 2013, http://www.usatoday.com/story/news/nation/2013/07/02/college-default-rates-higher-than-grad-rates/2480295/.
52. Bratton, "On the Nomos of the Cloud".
53. Chris Harrison, "World City to City Connections," last modified 2011, http://www.chrisharrison.net/index.php/Visualizations/InternetMap.
54. Metahaven, "The Cloud, the State, and the Stack: Metahaven in Conversation with Benjamin Bratton".
55. Bill Cheswick, "The Internet Mapping Project," last modified 2000, http://www.cheswick.com/ches/map/index.html.
56. "The Internet Looks Like a Fractal Dandelion," last modified November 11, 2011, http://discovermagazine.com/2011/nov/10-internet-looks-like-fractal-dandelion#.Up5SX8TDxXB.

Bibliography

"Aristotle." Last modified 2013. http://www3.nd.edu/~afreddos/courses/301/aristotl.htm#IB

Aureli, Pier Vittorio. 2011. *The Possibility of an Absolute Architecture*. Cambridge, Mass: MIT Press, 2011. ebook collection.

Bady, Aaron. "Tree Sitting." *The New Inquiry,* February 12, 2013.

Bady, Aaron. "The MOOC Moment and the End of Reform." *The New Inquiry*, May 15, 2013.

Balch, Tucker. "MOOC Student Demographics." last modified January 27, 2013. http://augmentedtrader.wordpress.com/2013/01/27/mooc-student-demographics/

Biemiller, Lawrence. "Guest Blogger: The Campus as Petting Zoo for Starchitects' Designs." *The Chronicle of Higher Education*, May 28, 2008.

Bellis, Mary. "The Invention of Television." last modified 2013. http://inventors.about.com/od/tstartinventions/a/Television_Time.htm

Bratton, Benjamin. "I-Phone city."*BRATTON.INFO*. N.p., n.d. Web. 30 Sept. 2013. <http://www.bratton.info/projects/texts/iphone-city/>.

Bratton, Benjamin. "Introduction to Speed & Politics." *BRATTON.INFO* . N.p., n.d. Web. 30 Sept. 2013. <http://www.bratton.info/projects/texts/introduction-to-speed--and--politics/>

Bratton, Benjamin. "On the Nomos of the Cloud: The Stack, Deep Address, Integral Geography." Berlage Institute. Berlage Institute, Rotterdam. 30 Nov. 2011. Lecture.

Bratton, Benjamin. "Surviving the Interface: the Envelopes, Membranes and Borders of Deep Cosmopolitics." Existential Risk. University of Michigan. University of Michigan, Ann Arbor. Oct. 2010. Lecture.

Bratton, Benjamin. "What We Do is Secrete." *BRATTON.INFO* . University of California, San Diego, n.d. Web. 30 Sept. 2013. <http://www.bratton.info/projects/texts/what-we-do-is-secrete/>

Cheswick, Bill. "The Internet Mapping Project." last modified 1998. http://www.cheswick.com/ches/map/index.html

Collegeboard.org. "Trends in Student Aid." last modified 2012, http://trends.collegeboard.org/sites/default/files/student-aid-2012-full-report-130201.pdf

Collegecalc. "Costs to Attend University of Phoenix Online Campus." last modified 2013. http://www.collegecalc.org/colleges/arizona/university-of-phoenix-online-campus/#.Up6WNcTDxXB

Corbin Ball. "1980-2012- A 30+ Year Timeline of Meetings Technology Innovation." Last modified 2012. http://www.corbinball.com/articles_technology/index.cfm?fuseaction=cor_av&artID=8878

Cornell University Facilities Department. "Find Facility Information." last modified 2005. http://www.fs.cornell.edu/fs_facilFind.cfm.

Chantrill, Christopher. "Government Spending Chart." Last modified 2013. http://www.usgovernmentspending.com/spending_chart_1900_2015USp_15s1li011mcn_24s24f

Coursera. "About Coursera." Last modified 2013. https://www.coursera.org/about.

Crompton, Dennis. "Plug-in City Study." last modified 2010. http://archigram.westminster.ac.uk/project.php?id=56

Delbanco, Andrew. "MOOCs of Hazard: Will Online Education dampen the college experience? Yes. Will it be worth it? Well..." Last Modified March 31, 2013. http://www.newrepublic.com/article/112731/moocs-will-online-education-ruin-university-experience.

Dennis, Marguerite J. "The Impact of MOOC on Higher Education." *College & University*, 2012. 24-30.

DeStantis, Nick. "Stanford Professor Gives Up Teaching Position, Hopes to Reach 500,000 Students at Online Start-up." *The Chronicle of Higher Education*, January 23 2012.

Discovery. "The Internet Looks Like a Fractal Dandelion." last modified November 11, 2011. http://discovermagazine.com/2011/nov/10-internet-looks-like-fractal-dandelion#.Up6WJcTDxXB

Fuller, Buckminster. "Education Automation." Southern Illinois University Press. Carbondale and Edwardsville Feffer & Simons, inc. Southern Illinois University, Carbondale. 1962. Lecture.

Fuller, Buckminster. *On Education*. Amherst: The University of Massachusetts Press, 1979.

Geiger, Roger. "Financial Trends in Higher Education: The United States." Last modified January 2011. http://www.ed.psu.edu/educ/cshe/working-papers/WP%236

General Data Resources, Inc. "Antenna Search." last modified 2009. http://www.antennasearch.com/

Greenberg, Alan. *Architecture of Democracy*. New York: Rizzoli International Publications, 2006.

Hanford, Emily. "Inventing a New Kind of College." *American RadioWorks*. 2013.

Harrison, Chris. "Internet Maps." last modified 2013. http://www.chrisharrison.net/index.php/Visualizations/InternetMap

Howard, Brian. "300 Years of Distance Learning." *National Geographic*. February 23, 2012. http://newswatch.nationalgeographic.com/2012/02/23/300-years-of-distance-learning/

Institution of Education Sciences. "National Center for Education Statistics." Last modified 2013.http://nces.ed.gov.

Jameson, Fredric. *Postmodernism or the Cultural Logic of Late Capitalism*. Durham: Duke University Press, 1991.

Malmcom, Alan. "How Cell Phones and a Telecom Tower Work." last modified 2013. http://alanmalmcom.hubpages.com/hub/How-Cell-Phones-and-a-Telecom-Tower-Work

MapMuse. "FCC Cell Phone Towers." last modified 2013. http://find.mapmuse.com/map/cell-towers

Marques, Juliana. "A Short History of Moocs and Distance Learning." last modified April 17, 2013. http://moocnewsandreviews.com/a-short-history-of-moocs-and-distance-learning/

Matt, Susan. "Before MOOCs, Colleges of the Air." *The Chronicle of Higher Education*. April 23, 2013.

McHale, John. "The Plastic Parthenon."*Dot Zero* 3 (1967): 98-110. Print.

McLuhan, Marshall, and Quentin Fiore. *The medium is the massage*. New York: Random House, 1967. Print.

Metahaven. "The Cloud, the State, and the Stack: Metahaven in Conversation with Benjamin Bratton." Last Modified 2013. http://mthvn.tumblr.com.

Nasseh, Bizhan. "A Brief History of Distance Education." last modified 1997. http://www.seniornet.org/edu/art/history.html

Pappano, Laura. "How online learning is reinventing college." *The Christian Science Monitor*, June 2, 2013.

Pettit, Joseph. "The Stanford Instructional Television Network." *IEEE Spectrum*. 1970.

Random History. "History of American Higher Education." Last modified 2013. http://www.randomhistory.com/1-50/039degree.html

Redhead, Steve. "The Art of the Accident: Paul Virilio and Accelerated Modernity."*Fast Capitalism*. The University of Texas at Arlington, n.d. Web. 30 Sept. 2013. <http://www.uta.edu/huma/agger/fastcapitalism/2_1/redhead.html>

Selingo, Jeffrey J. *College (Un)Bound*. New York: Houghton Mifflin Harcourt Publishing Company, 2013.

Shumski, Daniel. "MOOCs by the numbers: How do EdX, Coursera and Udacity stack up?" *Education Dive*. August 15, 2013. http://www.educationdive.com/news/moocs-by-the-numbers-how-do-edx-coursera-and-udacity-stack-up/161100/

StateUniversity.com. "Federal Funds for Higher Education - History, Federal Support for Students, Federal Support for Research." last modified 2013. http://education.stateuniversity.com/pages/1988/Federal-Funds-Higher-Education.html.

StatisticBrain. "College Endowment Rankings." Last modified April 28, 2013. http://www.statisticbrain.com/college-endowment-rankings/
Sumner, Jennifer. "Serving the System: a critical history of distance education." *Open Learning*. 2000. http://pages.towson.edu/bsadera/istc717/modules05/module8/3888263.pdf

TG Research and Analytical Services. "Higher Education Act: 40 Years of Opportunity." Last modified November 2005. http://www.tgslc.org/pdf/hea_history.pdf.

The Chronicle of Higher Education. "Where Does Your Freshman Class Come from." last modified October 29, 2011. http://chronicle.com/article/List-Freshman-Class/129559/

"The History of Computers." last modified 2013. http://inventors.about.com/library/blcoindex.htm

Thelin, John. "Higher Education in the United States- Historical Development, System." Last modified 2013. http://education.stateuniversity.com/pages/2044/Higher-Education-in-United-States.html

Tyson, Jeff. "How Internet Infrastructure Works." last modified 2013. http://computer.howstuffworks.com/internet/basics/internet-infrastructure1.htm

University of Minnesota. "Media History Project." Last modified May 18, 2012. http://www.tgslc.org/pdf/hea_history.pdf

University of Phoenix."Campus Locations." last modified 2013. http://www.phoenix.edu/campus-locations.html

U.S Cellular. "Voice and Data Maps." last modified 2013. http://www.uscellular.com/coverage-map/voice-and-data-maps.html

"U-Va. reinstated Teresa Sullivan After Weeks of Protests." *Washington Post*. June 26, 2012. http://www.washingtonpost.com/local/students-protest-university-presidents-ouster/

Virilio, Paul. "After Architecture: A Conversation." *Grey Room* (MIT Press: 2001): http://www.jstor.org/stable/1262565

Virilio, Paul. "The Museum of Accidents."*International Journal of Baudrillard Studies*. IJBS, n.d. Web. 30 Sept. 2013. < http://www.ubishops.ca/baudrillardstudies/vol3_2/viriliopf.htm>

Virilio, Paul. *The Original Accident*. Malden: Polity Press, 2007.

Virilio, Paul. "The Overexposed City."*L'espace Critique* (1984): Print.

Virilio, Paul. *Unknown Quantity*. New York: Thames and Hudson, 2003/

Wildavsky, Ben. *Reinventing Higher Education: The Promise of Innovation*. Cambridge: Harvard Education Press, 2012.

Wilson, Tracy. "How Streaming Video and Audio Work." last modified 2013. http://computer.howstuffworks.com/internet/basics/streaming-video-and-audio4.htm

Windows. "How do hubs, switches, routers, and access points differ?" last modified 2013. http://windows.microsoft.com/en-us/windows-vista/how-do-hubs-switches-routers-and-access-points-differ