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Laboratorization of time-space: An inquiry about the role of space in the control and reproduction of life

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Abstract
This paper displays the crucial role of space in conditioning both humans and nonhumans in the post-industrial era, situating itself at the crossroads of biopolitics, political philosophy and architectural theory. It argues that spatial conditioning, achieved through specific architectural designs, is a key strategy for colonizing living beings. The laboratory is analyzed as a spatial archetype where beings are extracted from natural habitats and subjected to processes that simulate life in artificial environments. In these environments, beings undergo ontological and epistemological restructuring, conditioned to ideal forms of objectivity and subjectivity via scientific methods, making the laboratory a practical apparatus for power. The study reviews the historical evolution of modern laboratories and their functioning as world-building environments. This foundation supports a comparative analysis of architectural cases designed for human and nonhuman beings, revealing connections in spatial planning, functionality, control strategies, safety protocols, and performance objectives that influence research outcomes. The investigation shows that various spaces—such as educational institutions, agricultural lands, botanical gardens, greenhouses and animal farms—mirror laboratory functions, actively manipulating the relationships between time and space for their inhabitants. Ultimately, this research contributes to the existing literature by creating a theoretical framework for future research on the relationship between space and power, integrating the experiences of nonhuman beings into architectural theory studies that have traditionally focused on human perspectives.

Keywords
Biopolitics, Condition-space, Control, Laboratory, Nonhuman spaces.

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1. Introduction

Regarding capitalist relations of production, the earth is valued solely as an economic asset. Capitalism is a system not only based on exploiting nature, colonies, and laborers (Hudson, 2021) but also dependent on the earth with all its living and nonliving beings for accumulation (Moore, 2015; Kenney-Lazar & Kay, 2017; Haraway, 2008). Whether human, animal, plant, water, forest, mine, or soil, all beings are transformed into a performative (Lyotard, 1984) element, and life is controlled and continuously reproduced [1].

One of the main arguments of this investigation posits that the fundamental mechanism of reproduction operates through the exertion of control over entities, with the subsequent extraction of utility from them. This process necessitates the establishment of delineated spaces replete with specific regulations and conditions, a domain in which architecture plays a pivotal role. As a discipline engaged in generating spatial constructs, architecture has long been instrumental in facilitating capitalist modes of production and the consolidation of power (Tafuri, 1973; Harvey, 1985, 2001; Foucault, 1995, 2003; Lefebvre, 1991). Beings are systematically disciplined, conditioned, and reproduced by orchestrating spatial arrangements, encompassing the micro-scale of individual buildings and the macro-scale of urban and global landscapes. Accordantly, this study aims to reveal the role of space in conditioning human and nonhuman beings to become more beneficial subjects and objects for power and capital.

The primary strategy for getting 'performance' from living beings is 'conditioning.' To govern humans and nonhumans, they must conform to the forms of subjectivity or objectivity determined by power. For instance, beings are conditioned to be students in school; workers in the factory; soldiers in the barracks; refugees in the camp; parents or children at home; crops in the field; livestocks on the farm; ores, dams, or power plants on the earth. Domestication, confinement, taming, discipline, training, experimentation, and pacification are a variety of techniques of conditioning human and nonhuman beings to make them fit for use/production, and space plays a critical role in all of them.

In order to understand how space is instrumentalized in the conditioning of beings, the concept of biopolitics from critical theory and political philosophy offers an essential ground for discussion. The concept of biopolitics, which is a combination of the Greek words bios (life) and politikos (politics), includes policies related to the control and reproduction of life. Since the biopolitics debates range from the human body to the animal body, from a plant to a mine, and from living labor to immaterial labor, the concept has a rich repertoire in different scales. This breadth of application underscores the concept's versatility and critical capacity for interrogating various focal points of life's politicization (Lemke, 2011).

The concept of biopolitics was first used by Foucault and is considered on two axes: the discipline of human beings individually and the policies related to the governance of the population. After Foucault, the concept of biopolitics, to which many thinkers from various fields such as sociology, philosophy, medicine, economy, law, geography and architecture have contributed, maintains its currency and contributes to many theoretical discussions (Foucault, 2000,2003; Agamben, 1998; Hardt & Negri, 2000,2004; Haraway, 1991; Rabinow, 1992; Fehér & Heller, 1994; Masters, 2001; Fassin, 2001; Nancy, 2002; Braun, 2007; Esposito, 2008).

In the realm of architectural theory, there is a discernible inclination to engage with the concept of urban space creation through a dialogue that encompasses critical notions such as the 'production of space,' 'right to the city,' 'everyday life,' and 'urbanization of capital.' These discussions are notably propelled by the theoretical frameworks of Lefebvre and Harvey, which are deeply rooted in the Marxist political economy. However, the discourse on space and biopolitics predominantly draws upon the intellectual trajectories of Foucault and Agamben. Foucault's theories are particularly influential in examining disciplinary spa-

ces that intersect with the governance of individuals and the broader debates on urban planning and population management (Wallenstein, 2009; Adams, 2014). Agamben's work, conversely, is frequently invoked in contemporary discussions surrounding the notion of camps, especially within the context of refugee debates. Despite the potential to explore urban transformation practices—ranging from modifications in zoning laws to phenomena such as gentrification, the emergence of ghettos, mega-projects, and the dichotomy of production and consumption spaces—through the lens of biopolitics, this avenue remains largely underexplored within the academic literature.

The prevailing discourse within the literature on architecture and biopolitics focuses primarily on human existence. However, the nexus between biopolitics and spatial organization transcends the confines of human life to envelop a broader spectrum of living entities, including nonhuman organisms. For example, a dam is constructed considering the body and movement of water. Greenhouses and botanical gardens are organized according to the bodies of the plants to be grown in them, and farms are according to the bodies of animals. Although all these productions are not included in the anthropomorphic jargon of architecture, they use architectural techniques and methods. The manipulation and organization of space thus play a pivotal role in directing and constraining the movements and behaviors of human and nonhuman life forms. By delving into the implications of spatial production on nonhuman entities, this study seeks to bridge the existing void in scholarly literature, advocating for a more inclusive examination that acknowledges the significance of nonhuman actors in the discourse on biopolitics and spatiality.

In this direction, the schools of thought of Michel Foucault and Donna Haraway constitute the two main axes of this theoretical perspective. This exploration critically engages with Foucault's investigation into how spatial dynamics are instrumental in the economization of human subjects, alongside Haraway's inquiry into the spatial conditioning of nonhumans towards specific forms of objectivity. Central to this discourse is examining the 'laboratory' as a quintessential model of spatial conditioning, prompting a rigorous historical analysis of its genesis and subsequent societal transformations.

This scholarly endeavor elucidates the laboratory's pivotal role as a conditioning-space, further extending the perspective to include various everyday structures that embody laboratory-like characteristics. The discourse involves a comparative examination of contemporary architectural instances utilized by both human and nonhuman entities in daily life. Such comparative analyses are indispensable, shedding light on the broader mechanisms through which spaces function as instrumental tools in controlling and reproducing beings. Consequently, this study lays a robust theoretical groundwork for ensuing research focused on the intersections of architecture, nonhumans, and biopolitics, contributing significantly to the academic discourse on space and its effects on beings.

2. Theoretical framework

While Foucault uses the concept of 'biopolitics' for the first time in the session titled "The Birth of Social Medicine" of the seminar series he gave in Brazil in 1974 (Foucault, 2000), he discusses the concept generally through two poles. The first is the "anatomo-politics of the human body" as a strategy that treats the body as a machine, taming it, increasing its abilities, revealing its potential, and developing its usefulness and obedience in parallel. The other pole is the "biopolitics of population" as a systematic system that controls and regulates birth and death rates, health level, life span, and all the conditions that will affect them by considering the body as a biological entity (Foucault, 2003).

On the other hand, Haraway extends Foucault's concept of biopolitics to include nonhuman animals and focuses on the problem of "reinventing nature." Haraway's examination transcends mere human-animal dichotomies, delving into the complex epistemologi-

cal and ontological demarcations that segregate humanity from nature, organic from mechanical, the natural from the cultural, the private realm from the public sphere, and gender distinctions between women and men. As a method for this, it uses a language loaded with metaphors and figures. The founding elements of this language are figures such as "cyborg, oncomouse, fetus, primate, and chutulu." Through these figures, Haraway questions biopolitical, biotechnological, and feminist theories (Haraway, 1991) while tracing a new world that resists the "informatics of domination" (Haraway, 1991), which she describes as a worldwide production/reproduction and communication system.

The discourse on biopolitics, initiated by Foucault and expanded upon by Haraway to encompass nonhumans, fundamentally grapples with the mechanisms of control and conditioning exercised over beings. This conditioning dynamic sometimes aligns with centralized authoritarian powers; at other times, it corresponds with neoliberal governance and capitalist modes of production. For Foucault, the epitome of this conditioning arena is represented by the Panopticon [2] designed by Bentham (1785) , a metaphorical and physical structure of omnipresent surveillance (Foucault, 1995), whereas Haraway situates the laboratory as the contemporary locus of such biopolitical exercises (Haraway, 1991; 2008).

To validate the proposed hypothesis, the research adopts a dual-methodological framework. Initially, a retrospective analysis delineates the emergence and spatial dynamics of the laboratory as a site of control. Subsequently, a comparative examination elucidates the characteristics that define the laboratory, juxtaposing spaces designed for human and nonhuman beings.

2.1. The birth of the laboratory

The laboratory first appeared in the 17th century. In the European civilization, scientific pursuits and associated experimental techniques gained popularity by the middle of the 17th century. For instance, in England, the budding "laboratory" of the Royal Society [3] and other "experimental" locations create what society eagerly seeks. According to Shapin and Schaffer (1985), the legitimacy of the experimental activity and trust in the laboratory and scientific studies are established when these experiments can effectively respond to expectations. Thus, the demands expected from the experimental community gradually spread to the society's economic, political, religious, and cultural activities. For instance, army artillerymen once approached physicists at the Royal Society with their application issues to improve their artillery's effectiveness. Brewers would consult chemists for more reliable beer, much as surgeons resorted to mechanical philosophers for a theoretical framework to explain fire behavior. As a result, the experimental laboratory is today recognized as a setting where practical knowledge is generated (Shapin & Schaffer, 1985).

According to Shapin and Schaffer, a laboratory is a performance setting where beings undergo checks and tests to generate new knowledge and objectivity. These studies have been carried out with a display system in full view of the public, and nonhuman beings, as well as machines, plants, and minerals, have been investigated and evaluated from various angles. One of these academic tests is Robert Boyle's Air Pump. In their seminal work, Leviathan and the Air Pump (1985), the authors analyze the historical significance of experiments in producing scientific knowledge. During this process, they follow Robert Boyle's usage of the air pump and pneumatics research. The most crucial advantage of Boyle's air pump is that, thanks to the transparency of the glass, it is "insulated from external conditions," and the experiments under control can be easily observed.

According to Haraway, another essential feature of Boyle's open laboratory is that it develops as a controlled public space that determines in detail who can legitimately stay there (Shapin & Schaffer, 1985; cited in Haraway, 2008). Shapin & Schafer (1985) emphasize that this newly emerging laboratory has become a limited public space. When someone wants to experiment, they come to this area and work with

different people, or when someone wants to see new phenomena created through experiments, they come to this area and observe with different people (Shapin & Schaffer, 1985).

Thus, the laboratory is a disciplinary space where authorized persons collectively control experimental, discursive, and social practices. At the same time, it has come to the forefront as a place where more reliable information is produced rather than simple observations of nature can be made. Thus, since the 17th century, witnessing has gradually ceased to be a subjective evaluation made by a selected group of people and assumed an epistemological identity established through various experiments(Shapin & Schafer, 1985).

According to Haraway, the subjects of scientific experimentation, or "those who can quietly disappear," have gained the ability to witness rather than appear to be a (nonhuman) spectator since Boyle's time. The laboratory, which was designed as a location kept under strict "control," was converted into a theater of public persuasion (Haraway, 2008). In this respect, the laboratory serves as a modest witness, witnessing the reproduction of beings. One of these beings, OncoMouse™, is one of the essential figures of the Haraway ontology. OncoMouse™ was the first transgenic animal produced by researchers at Harvard Medical School in the early 1980s. This laboratory mouse, genetically modified by Harvard University's Philip Leder and Timothy Stewart by transferring an oncogene that can trigger the growth of tumors, has been used to advance cancer research (National Museum of American History, n.d.). It lives in a box miming the air pump chamber in Robert Boyle's house in 17th-century England. According to Haraway, the nature of these small animals is recreated here (Haraway, 2008).

The laboratory thus becomes a performance machine in which technoscience conditions the vital into specific forms of objectivity by isolating the vital from its existential environment. In terms of the realization of the actions of biotechnologies, space can also be considered a modest witness since the laboratory witnesses the process, like Boyle's Air Pump, as a specialized place/volume where epistemological confinement and material reproduction occur.

On the other hand, Shapin & Schafer (1985) argue that the laboratory is also a helpful device for constructing a model of a moral citizen. First, representatives of the Royal Society present themselves as a society that does not produce civil war and conflict seeks peace, and develops methods for effectively forming and maintaining consensus. The empiricist philosophers within them seek to produce knowledge that is ideal for society. Here is a concrete example of the ideology of organizing and maintaining a peaceful society between tyranny and radical individualism. Therefore, if political actors want to build such a society, they should visit the laboratory to observe how it works (Shapin & Schafer, 1985).

The laboratory concept extends into Foucault's (2003) critique of disciplinary society, where various spaces, including the laboratory, are instrumental in shaping individual and societal behaviors. Foucault discusses the "laboratorization" of space as key to controlling and producing subjectivities that align with societal norms. This is part of a broader strategy to regulate life processes and maintain population balance through mechanisms similar to those found in controlled environments, emphasizing the need for a societal "homeostasis". Foucault (1995) sees these practices as necessary for managing the biological aspects of human life, encompassing not just laboratories but also hospitals, prisons, schools, and other normative spaces.

> *"[…] the Panopticon was also a laboratory; it could be used as a machine to carry out experiments, to alter behaviour, to train or correct individuals. To experiment with medicines and monitor their effects. To try out different punishments on prisoners, according to their crimes and character, and to seek the most effective ones. To each different techniques simultaneously to the workers, to decide which is the best" (Foucault, 1995, pp. 203-204).*

Michel Foucault's analysis of the

Panopticon portrays it as a significant tool in understanding power dynamics, likening it to a "power laboratory" for experimenting on human behavior and control. This concept extends to institutions like hospitals and prisons, which, since their development in the 17th century, have functioned as disciplinary spaces akin to the Panopticon. Foucault argues that the emergence of these disciplinary spaces coincides with the birth of the laboratory, reflecting a broader historical shift in which disciplines began to exert a form of "general sovereignty" during the 17th and 18th centuries. These spaces function in such a way as to regulate the "anatomo-politics of the human body" on the one hand and the "biopolitics of the population" on the other. In other words, "individual discipline" is provided as a requirement of disciplinary power, and as a requirement of liberal governmentality, "individual self-government" is ensured (Foucault, 1995; 2003).

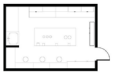
In the discourse on the anatomo-politics of the human body, a significant connection can be drawn to the disciplinary spaces within architecture. This intersection is notably explored by Wallenstein (2019), who integrates Michel Foucault's concept of biopolitics with architectural modernity, positing modern architecture as an integral component of the biopolitical apparatus. Wallenstein suggests a need to view the modern subject through a genealogical perspective and emphasizes understanding the panoptic principle as a 'diagram'—an abstraction with physical manifestations in various institutions like hospitals, prisons, and schools, where power is exercised in different forms.

Wallenstein (2019) delves into the symbiosis between architectural modernity and the organization and administration of life, alongside the generation of subjectivity, focusing on hospitals. He posits hospitals as 'laboratories' for experimentation with new concepts that eventually permeate the urban fabric. Such an association of hospitals as temporal and spatial 'laboratories' with the advent of modern architecture underscores the latter's evolution into a regulatory mechanism in life and human productivity, effectively transforming into a 'biopolitical machine.' As Wallenstein (2019) notes, this transformation parallels the decline in the relevance of classical architectural models in the latter half of the eighteenth century, marking the transition of architecture into a tool for "organizing, classifying, and managing space in its entirety." The laboratory is, therefore, one of the exemplary spaces of modernity, just like the factory, department store, and railway station (Galison & Caroline, 1999).

2.2. The laboratory as a conditioning-space

The retrospective analysis of the laboratory (Shapin & Schafer, 1985) and the discussions on biopolitics by Foucault (1995, 2003) and Haraway (1991, 2008, 2019) highlight the laboratory as a space for the control and reproduction of beings, evolving since the Middle Ages into a key site for scientific development and knowledge production across various domains like food, medicine, and agriculture. Haraway (2019) similarly states that scientists do not simply observe and experiment in the laboratory but also recreate a cell, for example, by observing, measuring, naming, and manipulating it. The laboratory is an artificial habitat where research and operations are conducted to adapt the beings processed to healthier, more practical, and more perfect forms using diverse scientific techniques. Within this framework, the scope of influence of the laboratory is expansive, extending from individual organisms to the entire planet and from singular buildings to urban conglomerates. This conceptualization of the laboratory underscores its role as a fundamental operational principle, one that has significantly shaped the functionality of numerous spaces within the contemporary world far beyond its tangible physical confines. For this reason, this study tried to reveal how the laboratory operates as a space. Such an inquiry is essential to determine the extent to which various modern spaces embody the characteristics of a laboratory, thereby influencing the conditioning and reproduction of

Table 1. *The properties of time-space in scientific laboratories, Boyle's Air Pump, Benham's Panopticon and Haraway's laboratory where live Oncomouse™.*

properties of time-space	Air Pump	Scientific laboratory	Panopticon	Animal testing laboratory
generic plan				
safety protocols	public	no unauthorised entry, dress code	no unauthorised entry, dress code	no unauthorised entry, dress code
atmosphere	sterilized, sanitary, luminous, silent	sterilized, sanitary, luminous, silent	silent, soft light, sanitary,	sterilized, sanitary, luminous, silent
enviromental control	neutral (temperature, damp, light)	neutral (temperature, damp, light)	neutral (temperature)	neutral (temperature, damp, light)
performance	manipulation(chemical, quantification, physical and genetic) , testing	manipulation(chemical , quantification, physical and genetic) , testing	discipline, chastening, taming	manipulation(genetic), quantification, testing, taming
mobile equipment	test fixture	table, test fixture, cabinet, shelf, lavabo etc.	bunk, bar, seat, wire fence, bowl	cage, bar, wire fence , bowl
time management	-	office hours, shift	shift	office hours, shift
classification	scientific	scientific,regulations	lawful, regulations	scientific,regulations

subjectivities within these spaces.

In this manuscript, we conceptualize the laboratory not merely as a physical locale for empirical inquiry but as a crucible wherein assets are optimized for performance. This understanding is elucidated by examining the etymology of the term 'laboratory.' Defined as "a room or building utilized for scientific research, experimentation, or testing" by the Oxford Learner's Dictionaries, the laboratory is a site where objects are subjected to the rigors of scientific postulates. The genesis of the word laboratory lies in the Latin labor, which encompasses meanings such as effort, work, pain, birth, and fatigue (Online Etymology Dictionary, n.d.). This etymological exploration reveals the intrinsic connection between the laboratory and labor—specifically, the performance context within this paper. Consequently, this paper argues that laboratories, and by extension, spaces that emulate the functionalities of laboratories, should be re-conceptualized as conditioning-spaces. These are arenas where entities are systematically conditioned towards varying degrees of subjectivity and objectivity to elicit performance.

The architecture and ethos of laboratory environments are defined by their functionality and purpose. Primarily, access is strictly regulated to authorized personnel, ensuring a controlled environment. Defined job roles and specific dress codes, including uniforms and protective gear, promote operational efficiency and safety. Control mechanisms in laboratories go beyond managing personnel to include the physical setup, like meticulously calibrated illumination for a shadow-free environment, enhancing specimen observation and experiment accuracy. Temperature regulation is also crucial, as even slight changes can affect living organisms' metabolic processes, especially microorganisms. Maintaining a constant, optimal temperature is essential for reliable experimental results and sample preservation. These practices highlight the importance of environmental control, safety protocols, and performance in creating a setting suited for high-precision scientific work (Hannaway, 1986; Crosland, 2005; Morris, 2021; Zhang & Cui, 2022).

The laboratory environment is quintessentially characterized by its hygienic and sterile conditions, meticulously maintained to minimize dirt and harmful microorganisms. Such an environment is paramount, as the nature of scientific inquiry necessitates a setting that is not only clean and orderly but also devoid of noise, thereby fostering an atmosphere conducive to focus and concentration. The spatial organization within the laboratory is methodically planned, delineating the precise placement of equipment and underscoring the significance of efficient time management during experimental procedures (Shapin,1988; Hannaway, 1986; Shackelford, 1993; Morris, 2021).

The laboratory design emphasizes white and non-reflective surfaces to minimize distractions and create optimal experiment conditions. This approach includes using neutral and transparent materials like white or glass for equipment and furniture, aiming for an unobtrusive, clean environment. The layout is carefully planned, with essential fixtures, equipment, and storage solutions strategically positioned to support experimental work (Hannaway, 1986; Shackelford; Morris, 2021). In summation, the laboratory functions as a crucible for constructing beings by establishing a controlled set-

ting that neutralizes external environmental conditions (Table 1).

While conditioning the existence on which it is processed according to scientific postulates, the condioning-space turns into a space that produces the prototype of beings and beneficial objects. This discourse posits that within the confines of such spaces, the essence of beings, abstracted from their intrinsic contexts, undergoes a metamorphosis into quantifiable outputs under the stewardship of accredited entities. The narrative extends to articulate that within these culturally constructed arenas, where the natural milieu is reconstituted through systematic conditioning, the subjects of such conditioning—ranging from microorganisms and botanical specimens to animals and humans—transmute into embodiments reflective of the epistemological foundations of their respective disciplinary domains.

The paper further argues that in contemporary settings, where conditioning of beings is prevalent, the dimension of time-space increasingly emulates the laboratory enviroment. To substantiate this thesis, the study undertakes a comparative analysis of various cases wherein both human and non-human entities are subjected to conditioning processes. The insights thus garnered furnish a theoretical scaffold pertinent to the discourse on the biopolitics of spatial domains, offering a foundational perspective for ensuing scholarly endeavors.

3. The comparative analysis and evaluation of condition-space cases

3.1. The cases of condition-space

In the conceptual framework posited by the study, "laboratorization" of the time-space emerges as contingent upon the imposition of varying degrees of subjectivity or objectivity upon the inhabitants therein. This "condition space" model extends beyond traditional labs to urban settings like homes, schools, hospitals and factories, as well as non-human environments such as zoos, animal shelters, animal farms, power farms, greenhouses, dams, and data centers. Each of these spaces embodies the condition-space model's principles, serving as sites for the observation, analysis, and modification of the living conditions of various entities, thereby underscoring the ubiquitous nature of the laboratorization phenomenon across both human and non-human spaces.

This study compares a school, a horse farm, an interspecies school, an animal shelter, and a greenhouse. Through this comparative analysis, the study investigates if laboratory settings create a dynamic of control that affects life across Earth. Thus, this research delves into how spatial arrangements and biopolitical agendas interact, enriching our understanding through the diverse perspectives of human, animal, and plant life.

3.1.1. Case I: Horse farm

The first illustrative instance scrutinized within this discourse is the Finca Ganadera Horse Farm, a project designed by OOIIO Architecture in Madrid. Built to train and care for racehorses and ride horses, this sports facility has been converted from a former cattle ranch in Castilla. Like the school space, which consists of classes and a garden that is surrounded by walls on all four sides, this horse farm consists of indoor and outdoor manege surrounded by walls on all four sides. One side of the open manage leans against the closed manage, while the existing structure in parallel surrounds the other three sides. Thus, the open management becomes a courtyard (OOIIO Architecture, n.d.).

In the project descriptions, the designers of OOIIO Architecture, the project owner, emphasize that every project detail is designed to make the horses as comfortable as possible. However, an equestrian area (manege) is ultimately a large area "fenced on all sides" with soft "floors" where riders and horses are trained. Concurrently, the design of the interior spaces is strategically oriented towards fostering optimal conditions for equine training, underscoring a holistic approach to architectural design that prioritizes the specific needs and welfare of horses (OOIIO Architecture, n.d.). In this sense, the spatial organization of the horse farm is designed as a perfor-

Figure 1. *Horse stables in Finca Ganadera, open-air manege and indoor manege (Image courtesy of OOIIO Architecture).*

Figure 2. *Horse stables in Finca Ganadera, horse riding hall. (Photographed by Josefotoinmo Courtesy of OOIIO Architecture).*

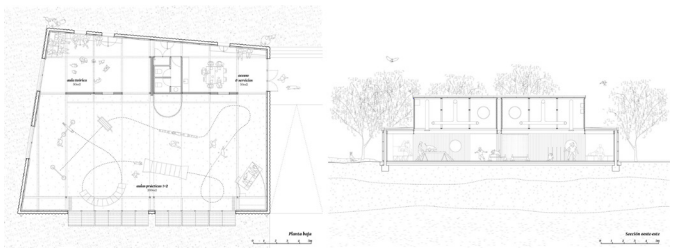


Figure 3. *The Educan School Dogs, Humans and Other Species, building ground floor plan and section (Image courtesy of Eeestudio + Lys Villalba).*

mance environment where foals are trained to become racehorses (Figure 1, Figure 2).

"The new building aims to protect against the weather, but it should also have a good lighting as neutral as possible. A lot of light but well distributed, shadows were not wanted that could distract or confuse the horses when jumping, so it is decided to open some skylights on the north deck, which fill the interior with natural light, without entering a single ray of sun." (OOIIO Architecture, n.d.).

3.1.2. Case II: Inter-species school

The Educan School, designed by Eeestudio + Lys Villalba, is located in a rural environment in Madrid that has been transformed in recent years by urban development and pesticide farming. The architects describe the building as an interspecies architecture where creatures such as humans, kestrels, swifts, sparrows, and dogs coexist. This integrative approach redefines the concept of learning spaces and posits the school as a microcosm of coexistence and mutual learning among different species (Eeestudio + Lys Villalba, n.d.).

The architects claim that they experiment with ways to improve the conditions of the ecosystem in this school, where dogs, other species, and humans are at the center of the design. For example, while the floor of a typical building is designed for the human body and its extension, the shoes in this school are designed for the paws and joints of dogs. Similarly, PTE-based synthetic turf approved for dog training was used in the training classrooms, and semi-polished aggregate concrete made of river pebbles was used in the classrooms (Eeestudio + Lys Villalba, n.d.). Ultimately, this school was designed to create ideal conditions for training its beings, just like on a horse farm or in a school (Figure 3, Figure 4).

"The average eye height drops from over a meter and a half to just half a meter. Interior openings are raised to heights of more than one meter to avoid doggy distractions; louvered window shutters shade the south facade, leaving enough space below for dog traffic to the outside, where rainwater from the roof is harvested in large troughs for dogs and birds" (Eeestudio + Lys Villalba, n.d.).

3.1.3. Case III: Animal refuge centre

The Animal Refuge Centre, designed by Arons en Gelauff Architecten, is the largest shelter in the Netherlands, and it was created by merging two animal shelters in Amsterdam. The architectural approach employed

by Arons en Gelauff Architecten adheres to a traditional comb model, characterized by a longitudinal service corridor flanked by kennels arranged perpendicularly, each separated by diminutive external spaces. A notable design feature is the inward orientation of the building, a deliberate decision aimed at mitigating the propagation of noise—precisely, the barking of dogs—to the surrounding neighborhood (Arons en Gelauff Architecten, n.d.).

The design integrates the service and kennel corridors into a singular, elongated structure that gracefully contours along the adjacent waterway, encapsulating the plot. The building consists of two inner courtyards as large playgrounds for the animals. The layout of the cell-like chambers and passageways facing the courtyard is prison-like, as even the architects acknowledge (Figure 5, Figure 6).

> *"This model is dominated by railings and the look of it closely resembles a prison."(Arons en Gelauff Architecten, n.d.).*

3.1.4. Case IV: Greenhouse

The Vertical Farm Beijing, designed by Van Bergen Kolpa Architects, was built on the campus of the Chinese Academy of Agricultural Sciences, China's innovation center for fruit and vegetable cultivation. The building focused on innovation and education, this three-story transparent building houses a series of innovative vertical cultivation (Van Bergen Kolpa Architects, n.d.). In recent years, vertical gardening has become an essential actor in the integration of vegetable and fruit growing into the inner and periphery of the city to provide access to fresh and healthy food for millions of people living in metropolises (Banerjee & Adenaeuer, 2014). This building considers this need and offers a productive environment for cultivating vegetables and fruits through climate control technologies (Figure 7).

Like most modern greenhouses, this building has a light-section steel structure and glass panels. The choice of materials and structure aims to combine natural light and ventilation with an artificial growing environment. The facility employs natural ventilation methods and evaporative cooling techniques while leveraging passive solar

Figure 4. *Interior of the Educan School, from dog training area (Image courtesy of Javier de Paz).*

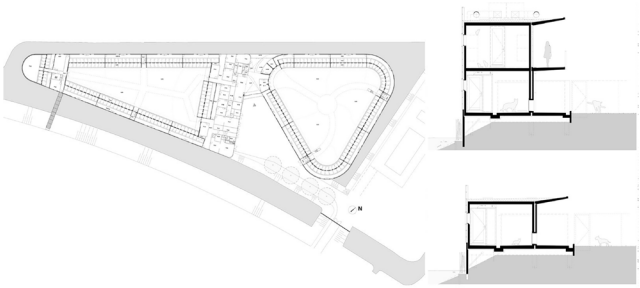


Figure 5. *The Animal Refuge Centre, building ground floor plan and sections (Image courtesy of Arons en Gelauff Architecten).*

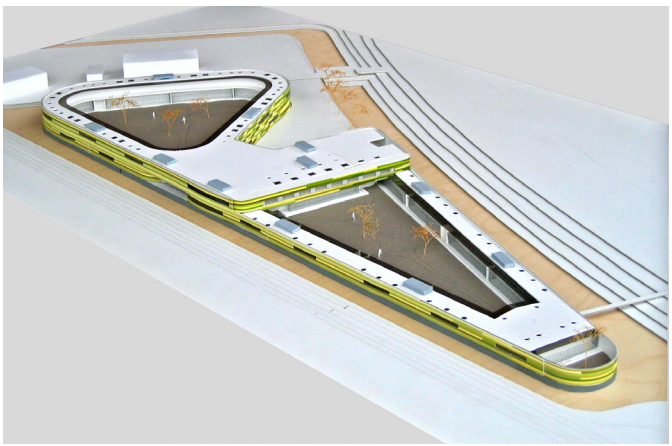


Figure 6. *The Animal Refuge Centre, Amsterdam (Image courtesy of Arons en Gelauff Architecten).*

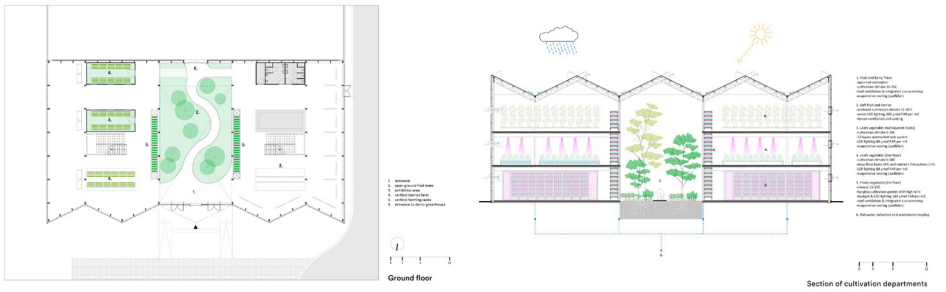


Figure 7. *the Vertical Farm Beijing, building ground floor plan and section (Image courtesy of Van Bergen Kolpa Architects).*

heating and the residual heat generated by LED lighting systems to maintain optimal temperatures (Van Bergen Kolpa Architects, n.d.). This building provides a control and reproduction environment to improve the performance of fruit and vegetable cultivation and also serves as part of people's educational experience (Figure 8).

"An educational route through the building leads visitors past fruit and berry trees in the open ground, automated vertical lettuce growing, fruit growing under LED light, and a rooftop greenhouse with tomato and cucumber growing under daylight" (Van Bergen Kolpa Architects, n.d.).

Figure 8. *Interior of the Vertical Farm Beijing (Image courtesy of Jin Weiqi).*

3.2. Comperative analysis and evaluation

This paper seeks to answer how space is instrumentalized in controlling and reproducing life through the theoretical framework of biopolitics. By focusing on Foucault and Haraway's discussions on biopolitics, the study tries to make visible the role of space in the conditioning of human and non-human beings. This approach was developed by analyzing the laboratory's historical process and spatial functioning as a spatial model of the act of conditioning. The conceptual framework from analysis formed the basis for the comparative analysis of various architectural cases. The study's findings show that there are various connections in the plan solution, spatial functioning and atmosphere, control strategies, spatial equipment, equipment and furniture utilization, time management, and performance goals of the buildings that will directly affect the research results.

The plan layout is mainly similar to the Panopticon in the examples of schools, horse farms, animal shelters, and interspecies schools. Inner courtyards, cell-shaped rooms, and corridors opening to the courtyard ensure movement control and create a sharp distinction between inside and outside. The open and closed management in the horse farm, the circulation with two separate corridors and an inner courtyard for cats and dogs in the animal shelter, the courtyard and classroom-corridor layout in the school, and the inside-outside separation in the interspecies school function similarly. The Animal Refuge Centre and Finca Ganadera Horse Farm, both featuring two separate inner courtyards and resembling the panoptic plan layout, are also located on the city's periphery, similar to many prisons.

In the analyzed cases, the space-performance relationship emerges in two manners. The first is related to the education of the beings, and the other is related to obtaining products or outputs from them. In this sense, living beings are conditioned to forms of subjectivity in the interspecies school, animal shelter, and horse farm. In contrast, in the greenhouse, they are conditioned to forms of objectivity to create pro-

ducts. The school is a laboratory where humans are conditioned to become doctors, engineers, lawyers, etc.; the horse farm is a laboratory where foals are conditioned to become racing or riding horses; the animal shelter is a laboratory where cats and dogs are conditioned to become vaccinated, harmless domestic pads; the interspecies school is a laboratory where humans and animals are conditioned to become educated, directable social beings.

The primary function of conditioning in all these spaces is taming. The most common social space of taming is the school, a place of discipline and education. A child enrolled in school is trained and conditioned to become an ordinary citizen—professional, married, and tax-paying—in the future. Through time-space management and epistemological conditioning, the school serves the purpose of producing subjectivity. Therefore, it is crucial to conform the "human mind and body" to the social order and to discipline them through educational circumstances (Foucault, 1995). Thus, the system's continuation is guaranteed.

"In the eighteenth century, 'rank' begins to define the great form of distribution of individuals in the educational order: rows or ranks of pupils in the class, corridors, courtyards; rank attributed to each pupil at the end of each examination; the rank he obtains from week to week, month to month, year to year; alignment of age groups, one after another; a succession of subjects taught and questions treated, according to an order of increasing difficulty. And, in this ensemble of compulsory alignments, each pupil, according to his age, his performance, his behaviour, occupies sometimes one rank, sometimes another…" (Foucault, 1995, pp. 146-147).

Foucault mentions that assigning students to specific classroom locations makes simultaneous supervision of each student possible. Thus, a new "learning time economy" is established. In this way, "[i]t made the educational space function like a learning machine, but also as a machine for supervising, hierarchizing, rewarding." (Foucault, 1995, p. 147). Therefore, it is possible to interpret the training process as a 'conditioning' process. So much so that the schools that ensure the maintenance of the system are people; they divide them into categories such as age, gender, class, continuity, discipline, attendance/absence, success/failure, and diploma. These assumptions are vital for accelerating and controlling the process of producing subjectivity.

In the delineated spaces that facilitate the perpetuation of societal norms and functions, demarcations are established based on the species, age, and gender of the entities within these confines. For instance, in educational institutions, students are segregated based on chronological age, ensuring a homogenous learning environment. Similarly, in equine breeding facilities, young horses are sorted by their physical development, precisely height, to tailor their care and training regimes. In the context of animal shelters, the categorization process considers both species and gender, allowing for a structured environment that can address the unique needs of each animal. This methodical approach to spatial organization underscores a broader strategy of managing and optimizing the interaction of diverse groups within controlled settings, thereby maintaining order and facilitating the smooth operation of these microcosms of society.

The other way to get asset performance is to turn them into efficient products. The greenhouse, analogous to the laboratory housing the OncoMouse™, emerges as a conditioned space where assets—specifically crops—are cultivated under optimal conditions. Therefore, Vertical Farm Beijing, like all other greenhouses, can be described as a second nature within nature. A perfect combination of architecture and technology, modern greenhouses are more than just places that provide climatic conditions for growing vegetables. Firstly, the greenhouse spatially separates the crop from the environment, thus providing some form of protection from the direct influence of external weather conditions. Therefore, producing crops that cannot be produced anywhere becomes possible. Secondly, greenhouse containment allows manipulation of the crop environment. Thus, it allows the

grower to direct the plantation in the desired way, and the spatial condition leads to higher yield (performance), longer production time, better quality, and less use of preservative chemicals. Thanks to this efficient use of space, greenhouse crops' added value (performance) per unit surface area is much higher than in open-field cultivation (Van Straten et al., 2011).

With today's technology, greenhouses have gradually turned into laboratories where the interior space can be 'manipulated' as desired by computerized control systems. For example, the temperature, humidity, and CO2 levels in the greenhouse are variables that affect the growth and development of plants, their metabolic activities, and the homogeneity of crops (Van Straten et al., 2011). Here, both various control technologies and genetic practices are used to idealize the structure of vegetables to be the most productive. Therefore, the greenhouse environment is a conditioned space where temperature, lighting, ventilation, humidity, irrigation, and nutrients are controlled in addition to the external climate.

When we look at other examples, we see that similar control methods are used. In the classrooms of a school space, having appropriate light, appropriate temperature, and appropriate air circulation is one of the conditions that enable students to concentrate on their education. It is understood from both the architects' statements and the project details that the use of light, heat, and sound control at a level does not distract the horses' attention in Finca Ganadera Horse Farm and the dogs in Education School during training.

These cases present the importance of creating 'neutral' conditions reminiscent of a laboratory setting to enhance performance and learning outcomes in both humans and animals. This comparative analysis illustrates the broad applicability and significance of environmental control in diverse settings, highlighting its role in optimizing conditions for agricultural productivity, educational efficacy, and the training of animals.

On the other hand, it is seen that the architectonic solutions alone are insufficient to realize the performances inside the condition space. In this sense, mobile equipment, time management, dress code, and entry-exit control are also effective in the conditioning of assets. For example, in a school divided into classes, mobile equipment such as desks, chairs, cupboards, lecterns, and blackboards are required for the lesson, which is one of the primary conditions of education. It is possible to see them as an interface that fixes the body's movement in the space divided into cells and connects it with limited information. Equipment such as the 'barrier,' 'table,' and 'chair' on the horse farm and inter-species school, the 'bunk bed' in prison, the 'stretcher' in the hospital, and the 'food bowl' in the animal refuge are the figures pointing to the conventions of the inside. These apparatuses, far from being mere functional items, are instrumental in reconstituting beings' nature, akin to the transformative experiments conducted on a laboratory table. This paper argues that integrating and strategically deploying such elements are essential for realizing space's full potential, extending the discourse beyond the architectural to encompass the operational and the experiential.

There are similar processes in terms of time management in these spaces. For example, a school space is based on rhythmic long-term fixation of the child's movement (lessons) and short-term release (recess), while a greenhouse frees the movement/body of the plant until it reaches a certain standard height. In a horse farm, the rider's and the horse's competence is tested against time according to criteria such as tracking, power, and running distances with a stopwatch. Furthermore, the spatial regulations within these environments highlight the restrictive access protocols akin to those in scientific laboratories. The imposition of specialized attire and identification protocols serves to demarcate the inhabitants of these spaces, further reinforcing the establishment of conditioned spaces as sites where distinct knowledge systems and ontological categories are crafted and maintained. Therefore, condition-spaces are places where the ontological and epistemological distinction is

constructed, as Haraway argues for the laboratory (Table 2).

Table 2. *The comparative analysis table of horse farm, school, interspecies school, animal shelter, and greenhouse samples in terms of time-space characteristics.*

Cases & properties of time-space	Condition-Space	School	Horse Farm	Inter-species School	Animal Shelter	Greenhouse
Spatial diagram						
Safety protocols	no unauthorised entry, dress code	no unauthorised entry, dress code	no unauthorised entry, dress code	no unauthorised entry	no unauthorised entry, dress code	no unauthorised entry, dress code
Atmosphere	sterilized, sanitary, luminous, silent	sterilized, sanitary, luminous, silent	sterilized, sanitary, luminous, silent	sterilized, sanitary, luminous, silent	sterilized, sanitary, luminous, silent	sterilized, sanitary, luminous, silent
Enviromental control	neutral (temperature, damp, light)	neutral (temperature, damp, light)	neutral (temperature, damp, light)	neutral (temperature, damp, light)	neutral (temperature, damp, light)	neutral (temperature, damp, light)
Performance	manipulation(chemical, quantification, physical and genetic) , testing	discipline, chastening, taming, education	discipline, chastening, taming, education	discipline, chastening, taming, education	discipline, chastening, taming	manipulation(chemical, quantification, physical and genetic) , testing, cultivating, gdo, irrigating,
Mobile equipment	table, test fixture, cabinet, shelf, lavabo etc.	table, cabinet, shelf, blackboard, rostrum etc.	barrier, fence, bowl	bunk, barrier, seat, fence, bowl	bunk, bar, seat, wire fence, bowl	bar, glass, soil, fertisile, sprinkler
Time management	office hours, shift	office hours, shift	office hours, shift	office hours, shift	office hours, shift	office hours, shift
Classification	scientific,regulations	scientific,age, gender,	height, age, gender,breed	scientific, age, gender,breed	age, gender,breed	scientific,breed, genus

4. Discussion

When the condition-space examples analyzed were compared, it was seen that were used to condition a horse on a farm, a human in a school, a dog in a shelter, and a plant in a greenhouse similar spatial strategies. This observation suggests that the principles governing spatial arrangement and its influence on behavior extend across species and contexts, indicating a broader applicability and potential for expansion into additional domains. For instance, the domestic space serves as a critical site for the construction of subjectivities, such as parental and filial roles. Drawing on Aureli (2013), the household emerges not merely as a private sphere distinct from the public domain but rather as a complex economic and legal apparatus that shapes and regulates the social and economic interactions of modern state citizens. In this capacity, the domestic environment functions simultaneously as a site of subject formation, by delineating normative behaviors and anchoring individuals to prescribed social positions, and as a financial instrument, enabling the utilization of personal savings for investment purposes. This dual function underscores the multifaceted role of spatial configurations in mediating between the individual and the collective, the private and the public. Parallel to this, Wallenstein's analysis of hospital architecture as a 'healing machine' further illustrates the capacity of spatial arrangements to discipline and regulate behaviors. Through architectural strategies such as separation, circulation, surveillance, and categorization, modern architecture reveals its regulatory potential in shaping human experiences and enhancing productivity, affirming spatial design's critical role in the broader socio-economic and cultural landscape. The laboratory is, therefore, as Galison and Caroline (1999) express, a model space of modernity, just like the factory, the department store, and the railway station.

Consequently, contemporary architectural practices have evolved to function as a 'biopolitical machine,' actively participating in regulating and producing life. Through this lens, it becomes evident that spatial strategies across various settings serve functional purposes and play a fundamental role in constructing and regulating subjectivities, underscoring the intrinsic relationship between space and power dynamics in shaping human and non-human lives.

The primary maneuver in these spaces, whose purpose of use and performance expectation is to condition beings to certain forms of subjectivity, is to create a physical distinction between 'outside' and 'inside.' An epistemological one follows the physical distinction. Through the application of performance-oriented spatiotemporal management, entities are controlled and guided. Inside, an artificial habitat, organized by architectural techniques, is constructed in which it is planned when and what to eat, what knowledge to learn and what to keep (curriculum), and which body can come side by side with other bodies.

In this conceptualization, spatial dynamics transform into a laboratory setting, thereby facilitating the production of subjectivity and objectivity. As time-space becomes a laboratory, the 'epistemological' and 'ontological' distinction between inside and outside becomes more pronounced. The prerequisite for being an urbanite is to pass through the condition-space filter. Individuals, through their developmental phases from domestic upbringing to formal education, eventually assimilate into professions where their

'performance' is critically evaluated. Therefore, the house is a laboratory for producing the family; the camp is a laboratory for producing the refugee; the factory is a laboratory for producing the worker; the shelter is a laboratory for producing the domestic animals; the farm is a laboratory for producing the racehorse; and the greenhouse is a laboratory for producing crops. Eventually, all conditions and spaces, such as Robert Boyle's air pump or the box containing OncoMouseTM, will be "modest witnesses" of what happens "inside." Thus, as time-space becomes a laboratory, beings are domesticated, organized, cultivated, and reproduced. This paper illustrates a complex interplay between space and biopower and offers insights into how scientific practices are embedded within and influenced by their socio-political contexts for future research.

Endnotes

1. The framework drawn for the concept of performance in this study is close to the concept of performativity that Lyotard discussed in The Postmodern Condition. Lyotard refers to performativity, which he thinks means "the effectiveness of the system," as a strategy to achieve the "best input-output ratio" in the control and production processes (Lyotard, 1984).

2. The Panopticon, conceived by the English philosopher and social theorist Jeremy Bentham in 1785, represents a paradigmatic model of prison architecture. Design is predicated on the principle of omnipresent surveillance, enabling a single watchman to observe all inmates without themselves being seen. Bentham's conceptualization of the Panopticon not only sought to revolutionize the penal system through architectural innovation but also aimed to instill a sense of constant surveillance within the psyche of the prisoners, thereby fostering a self-regulating behavior (Bentham &Bowring, 1843).

3. The Royal Society is an ensemble that has been conducting scientific activities in England since the second half of the 17th century (Shapin, Schaffer, 1985).

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