

Manufacturing Weather: The Carrier Igloo in Three Orders of Magnitude

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When introduced into the field of architecture, the notion of Anthropocene has inevitably fused natural and cultural processes, architectural and technological environments, as well as world and geology. No longer can architectural research overlook the very small (air molecules) and the very large (planets). Although architectural processes have long penetrated scales far beyond the human sensory, architectural histories have not projected meaning and value to these scales. This paper addresses issues concerning the scales of modern architectural processes with a particular focus on the development of air-conditioning technology in the early 20th century. It studies the first architecture dedicated to showcasing air-conditioning, the Carrier Igloo of Tomorrow, in the 1939 New York. The paper adopts “scale” as a method of investigation and examines the Carrier Pavilion in three orders of magnitude, encompassing molecules, bodies, and worlds. Drawing from historical photographs of the pavilion and promotion materials of the Carrier Corporation, this paper presents a multi-scalar montage of air-conditioning technology, the Carrier Corporation, as well as their architectural manifestations. On the one hand, the paper reveals the role that air-conditioning played in shaping the modern interior and the consciousness of its occupants. On the other hand, it argues that the meaning of air has not lost. It exists as the air-conditioning systems formally and physically intersect with buildings. By reconsidering how the human body might engage with architectural features like control panels, ducts, and vents, architects can access and even change the significance of air.

On April 30, 1939, amongst many other events in the New York World's Fair, the Carrier Igloo of Tomorrow held its grand opening. Covered with crystallized stucco coating, the five-story conical Igloo shimmered like a structure made of ice and snow that refused to melt under the late spring sunlight. Despite the hot weather, piles of snow stood in the way between visitors and the building. (Figure 1) The opening ceremony involved a group of “pretty girls” dressed in abbreviated Eskimo costumes who cleared a path in front of the Igloo with their shovels. (Figure 2) The Carrier pavilion was the first architecture dedicated to showcasing “the art of manufactured weather.”

By the side of the Igloo, stood the world's largest thermometer, the Carrierstat, broadcasting the weather of the fair-ground to visitors afar. Numbers on the Carrierstat might be the Igloo's only connection to its local climate. Inside the pavilion, palm trees flourished under a synthetic north light that flushed across the domed ceiling, lantern slides threw pictures of the Carrier installations on the wall, amongst which an animated display explained the four functions of air-conditioning—control of humidity, control of temperature, circulation of air, and cleaning of air. Climates from all around the world collapsed in the Igloo, so were the cultures that these climates nurtured. Located in a humid continental climate, the pavilion curiously adopted an Antarctic vernacular form. The building was promoted as “the envy of all Eskimos,” even though its interior was colder than the outside. A photo entitled “Apartment hunting, Eskimo style,” records an Eskimo family that stayed in the Igloo during the winter recess of the World's fair. (Figure 3)

Events related to the Carrier Igloo revealed issues of race and gender, which have been much discussed in historical works examining the first half of the 20th century. However, few have examined the role of technically controlled air in shaping these well-known power structures. The separation of design and environmental engineering has turned air into a technical term and architecture, aestheticized objects. For architectural historian Raynar Banham, the gulf between design and environmental engineering can only be reunited when the air-conditioned interior environment and the form of its shell can mutually determine each other. Banham, however, has not investigated how organizations, rather than architects alone, have employed architectural forms to explicate the meaning of air.

The 1939 World's Fair was intentionally designed as a site of education, and air was one of its pedagogical tools. Contrary to today's hidden environmental control systems, the HVAC system of the Carrier Igloo was exhibited as wonders. Attached to the windowless Igloo was the transparent Hall of Weather Makers, whose façade was entirely made of steel and glass. While serving as the air-conditioning plant for 79 other fair buildings, the Hall also offered a glimpse “behind the scene” of weather making. Through its architectural embodiment, the Carrier Corporation rendered air visible. Air-conditioning technology, though intended to engineer the interior weather, also had significance in shaping the habit of its users. As German



Figure 1. The Bird's Eye View of the Carrier Igloo. Manuscripts and Archives Division, The New York Public Library. "Carrier Corp. - Igloo - Exterior - With visitors in doorway" New York Public Library Digital Collections.

philosopher Peter Sloterdijk points out, being in the world also should mean being in the air. The modification of weather modifies the mode of human existence as well—air-conditioning is no less than air-training.

Despite its myriad problems, the term Anthropocene enables us to conceptually transcend boundaries between geology and world, objects and body, and biological and mechanical processes. In the ocean of air, the most intimate nature-culture exchange happens between body and weather. This relation invokes the problem of scale. Facing an epoch when "humankind has become a geological force," literary scholars like Timothy Clark and Derek Wood foreground the notion of scale effect, which describes moments when the frame of resolution and causality mismatch—one cannot find a town hotel merely by looking at a globe. Architecture is an art form but also a system

of physical and social processes, whose consequences exist beyond the perceivable scale of the human senses. Therefore, architectural historians and theorists also need to bring these other scales into the collective consciousness and start to investigate multiple scales at once.

Echoing these scale critiques, I propose to read the Carrier Igloo in three orders of magnitude. At the scale of molecules, I examine the mechanism of air-conditioning technology and its mythical lure. Zooming out to the scale of architecture and body, I discuss how air-conditioning has made uncontrolled weather into anomaly for economic purposes. As the Carrier Corporation manufactures weather, it also has shaped the human subjects at the same time. Finally, I examine the scale of geology and world. In the last section, following the global expansion of the Carrier Corporation, I investigate how the



Figure 2. The Opening Ceremony of the Carrier Igloo. Manuscripts and Archives Division, The New York Public Library. "Snow Girls shovel snow," New York Public Library Digital Collections.

propagation of air-conditioning has inadvertently caused the ozone depletion that eventually led to the coinage of the term Anthropocene. The conclusion argues that the meaning of air exists in the interface between technological systems and everyday life. Architecture equipped with air-conditioning systems constitutes such an interface. Architects can endow air with meaning through design.

MOLECULES

The novelty of air-conditioning manifests the most intensely at the level of air molecules. The Carrier Igloo adopted the architectural form of the Eskimo Igloo in order to bring forth the hidden mechanism that underlines the making of interior weather. While the concrete Igloo "dried air with water and cooled it with steam," the ice Igloo warms air with ice. How water might produce dryness, steam might cool air down, is

just as mysterious as how ice can possibly generate heat. The difference between the Carrier Igloo and its vernacular twin lies in how their interior environments are preserved. The coolth inside the former relies on the mechanical process of air-conditioning, whereas the warmth inside the latter depends entirely on the biological process of the human body. If the occupants leave the building, the coolth in the concrete Igloo would have endured, whereas the warmth in its ice twin is destined to perish. Because of its independence from the human body, air-conditioning makes the body work less to maintain the thermal comfort, which is also how it surpasses the vernacular architecture and becomes "the envy of all Eskimos."

It takes a heuristic process for laypeople to understand the mechanisms of weather making. The Carrier Igloo constituted a site that introduced the technological invention to the



Figure 3. "Apartment Hunting, Eskimo Style." Manuscripts and Archives Division, The New York Public Library. "Carrier Corp. - Eskimos - Family and dogs outside of igloo," New York Public Library Digital Collections.

public. However, by involving pretty girls and the Eskimos, the pedagogical events produced technological wonder and singled out its masters from its admirers through education. Historians of science, Lorraine Daston, and Katherine Park point out in their book *Wonders and the Order of Nature* that wonders had long been associated with moral judgments. During the Enlightenment, wonder marked the boundary between the order of nature and the sovereign of reason with its otherness. The enlightened individuals were expected to obtain self-fortified rationality and should appeal to reason even when presented with wonders. The love of marvel distinguished the vulgar from the enlightened. However, not everyone was believed to be equally at risk to vulgarity—women, the very young and the very old, primitive peoples, and the uneducated masses were prone to the designation of "the vulgar," leaving rationality as a privilege of white males.

By the time the Carrier Igloo appeared, air-conditioning had already conquered the realm of industrial production by regulating the interaction between air molecules and industrial particles. In the spring of 1902, Willis Carrier, then a research engineer in Buffalo Forge Company, received a commission from the Sackett & Wilhelms Lithography and Printing Company in Brooklyn, New York, to design an apparatus that could dry the air. The problem was that the expansion of paper in the humid air caused color blocks to misalign, which affected the quality of the company's fine prints. Carrier's apparatus was designed to produce architecturally enclosed weather.

In the pre-air-conditioning world, the weather had long posed problems for almost all industries. For aircraft manufacturing to candy production, from gun powder supply to energy transmission, weather determined the efficiency of labor and the quality of industrial products. The temperature, humidity, and purity of air affected all products indifferently at the scale of molecules. In its promotion brochure, titled *the Story of Manufactured Weather*, the Carrier Corporation invited its readers to imagine a world where candies did not come in uniformed sizes, printed color blocks mismatched, rubber products easily injured, chocolate coating were murky, chewing gums sticky, cotton threads too fragile, films dusty, and theaters suffocating. According to the brochure, mass production requires perfect weather. Through air-conditioning, weather, too, became a manufactured product that could be counted or metered like candies or electricity. In its collaboration with the US military during WWI, the Carrier Corporation furnish to the military industry "twenty-five tons of manufactured weather every minute." With air-conditioning, the internal architectural environment, rid from the ocean of air, could connect ever more closely with the economic and financial currents.

BODIES

The uncertainty of weather can be a fertile ground for political maneuvers. Corporations, as well as states, have long been trying to possess the weather through control. Like weather forecasts, air-conditioning takes possession of the weather by banishing it from the collective consciousness. In *Terrors from the Air*, Sloterdijk maintains that to consider meteorology merely as a natural science is to let the question of weather's possible author slide without an answer. By examining the gas warfare alongside the surrealist movement, Sloterdijk reveals that in the 20th century, air and context become inseparable. Not only does weather support and take away life, but it also determines the meanings of actions and texts.

The Carrier Corporation identified itself as a manufacturer of weather. Its earliest promotion brochure presents a history of the company's successful weather control cases in various industries, told through the spokesman of manufactured weather, Mechanical Weather Man. The figure of the Mechanical Weather Man derives from the control valve, a critical mechanical part that regulates the flow of steam and water in the Carrier apparatus. Frozen in a permanent smile, the Mechanical Weather Man wears a company uniform that says,

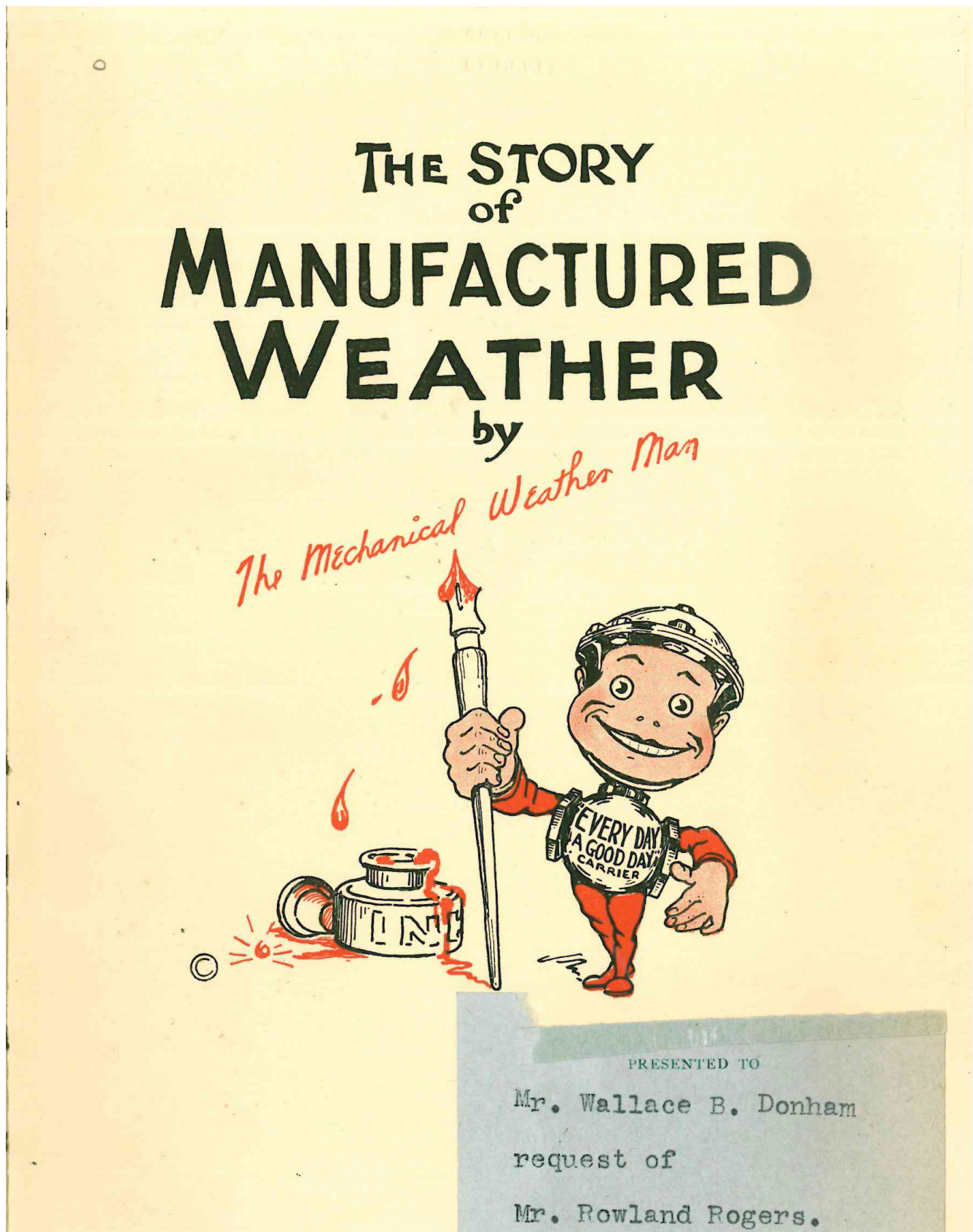


Figure 4. One of the drawings portrays the Mechanical Weather Man. Carrier Engineering Corporation, *The Story of Manufactured Weather*, p5

“every day is a good day.” he adjective “manufactured,” on the one hand, alludes to the technological prestige of manufacture industries in the early 20th century, and on the other hand, it also invokes the interior weather’s inseparable relation to texts. The manufactured weather is also fictional weather that can be written and erased as the author pleases. Holding a pen that is even taller than his body, the Mechanical Weather Man claims the authorship of interior weather. However, the lines coming out of the mascot’s mouth are nothing more than a ventriloquist performance. Behind him stands the Carrier Corporation, which immediately turns the control valve into a diligent servant. (Figure 4) While explaining how the control valve works, the brochure gives away the real author of the mechanical weather, “These little valves are simple, durable, and remarkably accurate. Although they have brains, they are tireless and efficient. They never sleep, they never require a vacation, and they never strike for higher wages. They are always on the job.”

As a hybrid of the organic body and mechanical parts, the Carrier mascot reveals the transformation of the body in labor. Manufactured weather replaces the natural environment with a human-made milieu that operates under economic laws. Through the Carrier Dew-point Thermostat, the user of the Carrier apparatus was able to customize the interior air. The instrument allowed industrial owners to modify the threshold of interior humidity and temperature according to their production needs. In the pamphlet, labor efficiency comes up as a fortunate side effect of dehumidification. The underlining point, however, is not the welfare of workers, but that air-conditioning has reduced friction in every node of production, machines and humans alike. Developed to streamline industrial processes, the Carrier apparatus turned into a device of training in workplaces. Invoking the scientific management, the pamphlet emphasizes how rationality and technological progress increase labor efficiency by improving the comfort of the laboring body. According to French Philosopher, Georges Canguilhem, Taylorism is “psycho-techniques” that trains the subject to react to machines as if they were also machines. The laboring human body, thus, became an organism that was not only determined but also sustained by its new mechanical milieu.

Manufactured weather reversed the condition between the normal and the pathological. According to Canguilhem, disease, since the 19th century, has become a dynamic concept that refers to the disturbance of the organism’s natural equilibrium.

The healthy body oscillates between hot and cold, wet and dry, as its environments shift. With its opacity, the air-tight and windowless Carrier Igloo rejected any external atmospheric disturbances. By creating a stable island within the turbulent air, the Igloo made health a static concept that required constant maintenance. Pavilions in the 1939 World’s Fair appeared to be an exact realization of the techno-utopia from the collective imagination of the 1930s America. Together, they formed a temporary city with “soundproof and windowless buildings” supplied with “medically prescribed light and weather,” which immediately turned the direct exchange between body and weather into a pathological phenomenon. As Canguilhem points out, without considering the milieu of an organism, health can only be an empty word. The normal and the pathological, thus, do not refer to the isolated organism, but describe its *relation* with the environment, as they reciprocally determine each other. With environmental control technologies, no longer can the pathological condition in human society remain biological. Canguilhem writes, “Human activity, work, and culture have the immediate effect of constantly altering the milieu of human life.” Conversely, one must recognize the social impact of the milieu’s active role. The human subject can be constantly remade through environmental conditioning, or air-conditioning, in our context. Because of instruments like air-conditioning, the normal in the 20th century started to rely less on the natural situation and more on the norms of production. In his 1948 book, *American Building: The Environmental Forces that Shaped It*, architect James Marston Fitch examines the role of air-conditioning in creating a comfortable interior environment. The importance of interior air lies in that it increases the occupants’ ability to work. Invoking the Aristotelian distinction between work and labor, Fitch emphasizes how work could transcend the human subject by bringing it beyond biological needs. In other words, air-conditioned architecture silently supports and reinforces the notion that the more one can work, the more human he or she is. In Fitch’s vision, as in Willi Carrier’s, architecture is no less than a life-supporting organ for workers.

WORLDS

Located on the reclaimed waste dump of the flushing meadow, the 1939 New York World’s Fair bore the name, the World of Tomorrow. Unlike its silent demolition, the construction of it appeared as “a melodramatic demonstration of scientific achievement” in the press, echoing the goal of the fair set out by its chief architect Robert Kohn. The fair, for Kohn, was meant



Figure 5. Photograph of the Model of Democracy. Manuscripts and Archives Division, The New York Public Library. "Theme Center - Democracy - Model of city and countryside" New York Public Library Digital Collections.

to construct a futurist world where technological advancement could eliminate all social problems. By fusing science, art, and commerce in the exhibits, Kohn turned the fairground into education for "men in the street." Almost as a miniature of the entire fair, Democracy (Figure 5), stood in the air-conditioned Perisphere, the exhibition hall at the center of the fair. As a faithful embodiment of the Garden City Utopia, the Democracy not only erased all tensions between social groups through technology and planning but also reduced frictions between production and the natural environment. As a fair promotion brochure asserts, "even the Democracy had not "managed to manage the weather," air conditioning and the automatic heat control can help the future world "to cope with it."

In 1979, the Carrier Corporation became a global air-conditioning supplier. Carrier China, for instance, was the first American air-conditioning manufacturer that appeared in China in 1985, shortly after the country's economic reform. Unlike other global corporations that produce their own architectural icons, Carrier China attaches to architectural forms created by other organizations. From the Water Cube Stadium of the 2008 Beijing Olympic Games to Shanghai World Expo Center of the 2010 Shanghai World Expo, from Pingan Financial Center, the tallest building in China to China Telecom Data Center, one of the most dominant Chinese internet suppliers, Carrier has achieved a symbolic world order through landmarks and world-class events. Architectural theorist Keller Easterling studies the spatial consequences of transnational organizations

in agriculture, tourist, religion, and manufacture. Posing spatial products against deliberately authored architecture, Easterling writes, “spatial products substitute spin, logistics, and management styles for considerations of location, geometry, or enclosure.” Technological systems, like air-conditioning, also create worlds. Rather than governing its worlds with their own rules, organizations like Carrier Corporation survives and expands by reinforcing norms for other worlds, such as that of agriculture, sports, and fashion. Morphing according to its architectural envelops, the manufactured weather is another species of spatial products. Air-conditioning transforms the biological ventilation processes of the human body into a continuous mechanical hum. For Easterling, the worlds of spatial products “aspire to be perfect utopias, singular domains attempting to coerce compliance from anything foreign to them.” Air conditioning breathes for its architectural occupants. It immediately distinguishes an interior from the exterior, separates the normal of the pathological. Following organizations like the Carrier Corporation, the Manufactured Weather became another geological stratus covering the Earth, serving many worlds.

The air-conditioning process has also caused inadvertent erosion of the earth’s stratospheric ozone layer. Atmospheric chemist Paul Crutzen, who accidentally coined the term Anthropocene in a 2000 conference, received the Nobel Prize for his research on ozone layer depletion. The chemical and physical processes of air-conditioning have long escaped the collective consciousness of the contemporary world. However, it is precisely these processes at the level of air-molecules that have caused the geological impact on the planetary scale. As attachments to buildings, air-conditioning units propagate faster and more discretely than any other economic bodies. However, it is already hard to distinguish the air-conditional world with the economic norms that it serves. Soon before people realize, the human body has already been trained to breathe and work in conditioned air. All that an air-conditioner needs is a hole in the exterior wall and a simple support structure on the façade. It does not recognize the difference between architectural styles, types, or programs, which have been critical to architectural historical researches.

CONCLUSION

The scale of the human body and architecture stands in between that of molecules and worlds. To be sure, physical and chemical processes employed in air-conditioning belong to nature. They enter the realm of culture only when they become

means that serve cultural ends. The geological consequence induced by air-conditioning could not have been possible without the penetration of the organizational mandate into the very large and the very small, which means architectural designers and historians also need to extend their consciousness to these domains. Air-conditioning equals air-training, in that by modifying the air, it molds the sensory ratio of its subjects and makes them comport themselves according to the economic norm behind every air-conditioning apparatus. In this process, architecture acts as a pivotal instrument that enables the governmentality of air-conditioning through its organizational force.

Against Sloterdijk, I argue that air is neither unperceivable nor meaningless, even in the contemporary world. Air means the world not only for people in poverty but also for air-conditioning manufacturers who determine the significance of air through their products. By examining air as medium, media theorist Eva Horn reveals the importance of aesthesis of air in the contemporary world. She writes, “Such an alternative explication (in art works) many render the states and dynamics of air available to human experience and help us renew the cultural and phenomenological relation to it. Regaining an aesthesis of the air might enable us to become sensible to our beings as being in the air.” However, let us not forget that in the 20th century, it is no longer possible to distinguish air from the context of interpretation. In art galleries, air-conditioning controls and trains its users and predetermines the possibility of their practices. Apart from art and literature, perhaps it is also important to examine the interface between technological systems and everyday life. After all, it is the on-and-off buttons, the thermal thresholds, and the air-conditioning units mounted on walls that signal to us what air means day and night.

Portrayed as “the envy of all Eskimos,” the Carrier Igloo exhibits technologies’ victory over techniques. The distinction between the two, in the scope of this paper, lies in the involvement of human body in the process of environmental control. Different from the ice igloo, where the heat comes directly from the bodily metabolism of its occupants, the thermal balance inside the concrete igloo relies solely on the mechanical processes of air-conditioning. By externalizing the body’s burden of generating or dissipating heat, Manufactured Weather reinforces the modern privilege of vision and rationality while effacing tactility through machine-generated comfort. According to Martin Heidegger, technology, by expelling the

incalculable qualities of things, objectifies the world and poses the modern subject against it. To overcome the gulf between the objective and the subjective, both Heidegger and Horn suggest bringing techniques to the fore. However, as media theorist John Durham Peters implicitly points out in his recent book, *The Marvelous Clouds*, technological systems have their own techniques. He writes, “techniques refer to practices of know-how, handicraft, and corporeal knowledge that interact with bodies and instruments...in cars, detailing and diagnostics are techniques, but camshafts and crankcases are technologies.” Similarly, air-conditioning apparatuses and architecture do not intersect without traces. Control panels, ducts, and vents constitute the architectural interface between the human body and air-conditioning. In other words, to establish or maintain the thermal equilibrium, someone had to operate the machines with his or her hands. Such corporeal engagement is the techniques of air-conditioning, and how one might operate the architectural weathermaking machine is a question of design. If the internal mechanical process of air-conditioning is not available to human senses, then the interface between the technological system and the human body is the only possible site where the meaning of air can rise again. Therefore, faced with the environmental crisis of climate change, for air to mean anything at all, architectural designers and historians have to bring the intersection between environmental control technologies and architecture form to the focus.

ENDNOTES

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