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BEYOND REASONABLE DOUBT
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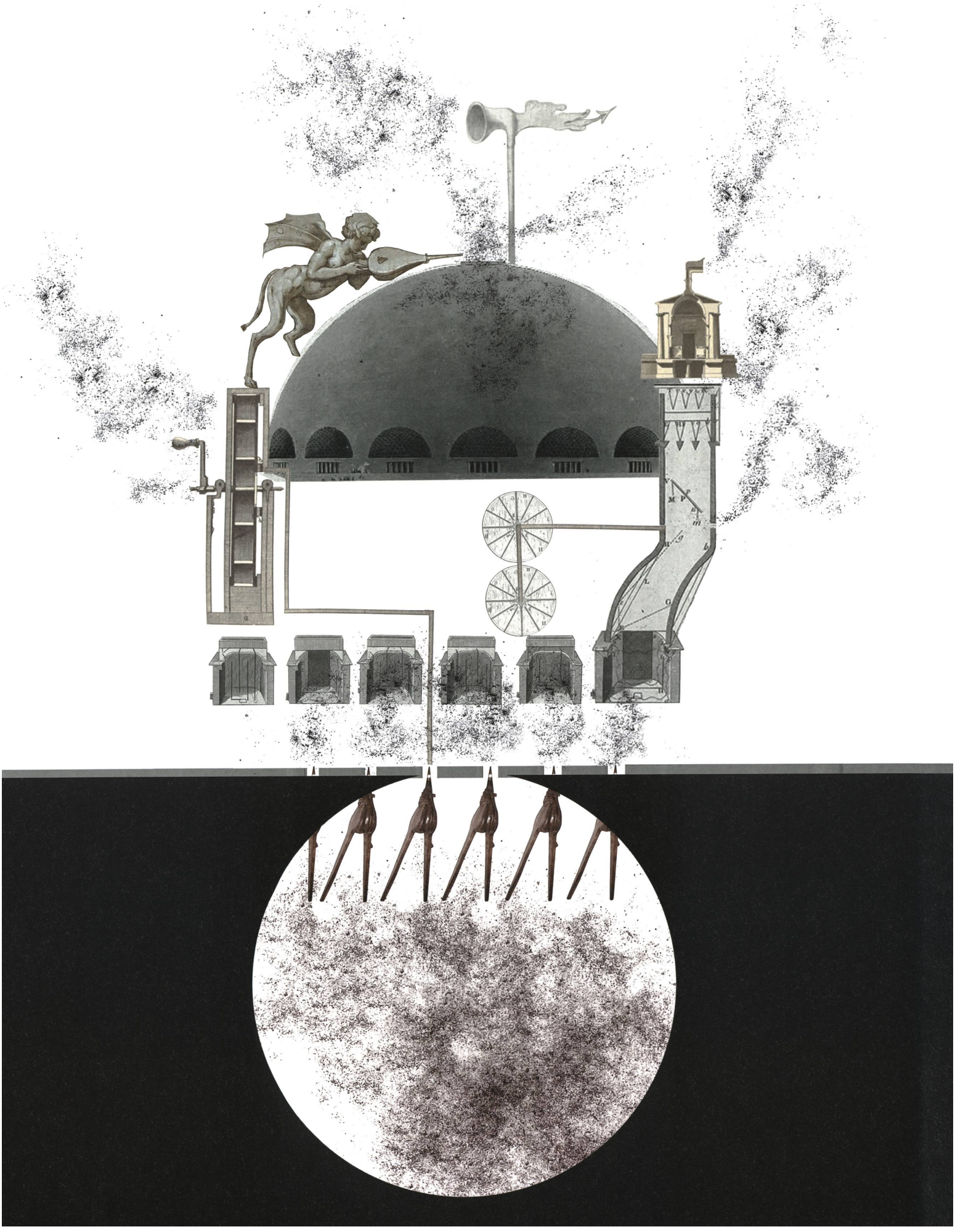

Air, unless polluted, is an invisible fluid, it can be felt on our skin, it can carry sound, temperature and humidity but it is somewhat illusive and intangible. Its transparency, one of its main characteristics, escapes our visual world of certainties and allows for it to be filled with interpretations. Throughout the history of humankind, air and wind have embodied and fostered a huge range of narratives that usually explain the most inexplicable of events. From ghosts to gods and secret messages, air has been the host of many inexplicable phenomena.

The nature of air, in explaining the inexplicable, in combination with the lack of scientific accuracy and the bacteria theory, propelled stories of the ‹evil› miasmatic air that could make everyone sick. Miasma was considered to be a certain air pollution that was identified in the 18th century in densely populated cities of the time, like Paris. The strong unpleasant odour that rose like a mist from the ground at night was considered to be polluted air that carried diseases and threatened people's health and lives. Two distinct sources for miasma could be identified: stagnant waters on the surface or cavities at the depths of the earth that rose in the form of evaporated air.[1] Scientific discoveries that revealed the chemistry of air and allowed it to be perceived as a living organism, developed at the same time as the miasma theories. The work of Stephen Hale and later Joseph Priestley revealed that air consisted of a variety of gases and that its chemical consistency was more complex than previously assumed.[2] The widespread understanding of air as a complex organism triggered a heightened perception and awareness of the harms and remedies that polluted as well as fresh air could provide. These discoveries that allowed air to be perceived in a specific way suspiciously coincided with the collective paranoia of polluted air, generally described as miasma.[3]

In those times the measuring tools for the quality of air had not yet been developed. A more sensorial approach towards the understanding of air was used, whereby smell and therefore the nose were treated as accurate scientific measuring tools.[4] The combination of scientific progressions and shortcomings created enough understanding to generate doubt. This doubt turned into paranoia with respect to the harms that this pollution could bring. Louis Pasteur's germ theory of the 1880s and 1890s managed to scientifically disassociate smell from polluted air and the cause of diseases, even though it took a considerable amount of time for general psychology to actually accept this.[5]

Furthermore, the ground was considered to be the source of the miasmatic polluted air. Stagnant waters and marshes were regarded as suspicious. More importantly, however, its fumes were seen as the residual heat coming from the earth's centre. Or, in further and more imaginative terms, these miasmatic fumes were believed to be buried bodies that had evaporated and escaped from the heat into the inhabited world through cracks and openings in the earth's surface.[6] Once the earthly ground was imagined as the vessel that entrapped such deadly fumes, any disruption or connection to that ground was viewed with suspicion. Earthquakes and volcanic eruptions were considered as moments that could crack the seal and release polluted air.[7] In addition to such larger, unpredictable natural disasters, human interventions on the ground were also regarded as provoking and disrupting the division of the world below and above ground. The realm that was described as being filled with miasmatic fumes from the dead had to be kept separate from the world above, thus protecting the world of the living. Agriculture and buildings were seen as moments of possible escape from polluted air.[8] These interventions were considered as being the spatial moments when the miasmatic air could find its way into the realm inhabited by humans.

As a reaction a number of interventions took place during the 18th century that took action against the infiltration of miasma. Such interventions took on a variety of scales, from objects, to larger ‹machines› to detail changes as well as to large urban transformations. Overall, three significantly different approaches to come to terms with polluted air can be identified.

The first approach was a series of mechanical devices, developed through apparatuses that were common in domestic interiors. Nicolas Gauger, in his book ‹The Mechanics of Fire›, presents an extensive study on how to turn a fireplace into a ventilating device for the room that it is in. Along with the understanding of hot air movement, a series of cavities allowed for the fireplace to be transformed into a ventilating device.[9] Later, a sequence of bellows attached with inward and outward valves was also claimed to have the capacity to change foul to fresh air in a room. This technique was developed by Dr. Hale and Martin Triewald, the head of mechanics to the King of Sweden. It was originally intended as a ventilating device in ships but was soon to be transported to the more static built environment. In 1752 it was used in Newgate Prison in London, this time as a more complex system with a windmill on the roof that triggered all necessary movement of the bellows below.[10] Further, around the same time, Sir Robert Moray, Dr. Desaguliers and Mr. Sutton also developed a system of pipes and chimneys for ventilation purposes. Even though the system was not extensively used, it became the basis for the system used at the House of Commons in London in 1836. All inventions were variations on the simple principle of ‹fire-draught suction›[11] that were along the lines of what Gauger had also developed earlier.

At the same time the second approach, of voided spaces, developed through a form of air entrapment and the introduction of porosity. Many studies were conducted to understand the movement and directionality of air. It was believed that foul air rose and traveled upwards which became an endorsement to increased ceiling heights of interiors. The height of rooms was also seen as the way that ensured a large amount of trapped air, which meant less contamination. Cupolas and vaults were seen as sucking devises that allowed for foul air to rise and be replaced by clean air.[12] Jaques Germain Soufflot built an exemplary elliptical vault for Lyon Hospital that acted through its geometry as a space for uplifting the contaminated air.[13] A widening of streets allowed for the existence of voids within the city, thereby allowing for more air movement and a more rapid renewal.[14] The demolition of fortifications also found strong support in relation to the aforementioned ideas of increasing voids in the densely inhabited areas in order to heighten air movement.[15]

Finally, the third approach, was a general shift towards hard and impermeable surfaces and the erasure of seams, that locked in the miasma and would not allow it to escape.

As miasma was considered to seep through the ground and through the buildings that were in contact with the same ground, a seemingly obvious reaction was the effort to seal these mediums that transported such deadly air. Plastering surfaces and the use of paint were seen as ways to keep even the smallest of cracks blocked while keeping the air, that had travelled from the center of the earth, locked in the walls.[16] The impenetrability of hard surfaces made them in general more preferable to soft ones, which were seen as enablers of the transmission of polluted air. Streets that were paved with cobbles were not considered as sufficient enough in keeping the miasmatic risk away. The numerous seams created a fractured surface that gave too many possibilities for the deadly fumes to escape. In Paris, for example, this resulted in their replacement with large granite flagstone pavers that were brought at a very high cost from England. The large uninterrupted and seemingly continuous surface alleviated fears that fumes would escape.[17] It created a reassurance from the false belief that miasma was going to infect the population of the city.

In this sense, the story of doubt is in some ways linked to that of air. Air is an elastic fluid that can take different shapes, smells and qualities, both physically and mentally. It is this elasticity that is often used to ‹fit› the answer we might be looking for. From ventilating devices to voids and cupolas to sealed public streets, these are some of the numerous changes such doubt created. The miasma theory, even though the collective imagination held on to it for decades, eventually disappeared; the changes it created, however, were permanent. These changes might not have ‹saved› our cities from miasma, but they considerably improved and transformed their image. The miasmatic doubt might have had its root in uncertainty, but it had a considerable effect on the built environment, resulting in very tangible changes and improvements throughout the city.

1 Ronald Rees, ‹Under the Weather: Climate and Disease 1700–1900›, in: ‹History Today›, Volume 46 Issue1, January 1996, p. 35.
2 Jeanne Kisacky, ‹Breathing Room: Calculating and Architecture of Air›, in: Anthony Gerbino (ed.), ‹Geometrical Objects: Architecture and the Mathematical Sciences 1400-1800›, Switzerland 2014, p. 249.
3 Rodolphe El-Khoury, ‹Polish and Deodorize: Paving the City in Late-Eighteenth-Century France›, in: Assemblage No.31, Cambridge 1996, p. 6.
4 Alain Corbin, ‹The Foul and the Fragrant / Odor and the French Social Imagination›, Cambridge 1986, p. 14.
5 Marks S.R. Jenner, ‹Follow Your Nose / Smell, Smelling, and Their Histories›, in: AHR Forum, April 2011, p. 346.
6 Alain Corbin, Alain, ‹The Foul and the Fragrant / Odor and the French Social Imagination›, Cambridge 1986, p. 224.
7 Ronald Rees, ‹Under the Weather: Climate and Disease 1700-1900›, in: ‹History Today 46:1›, January 1996, p. 35.
8 Rodolphe El-Khoury, ‹Polish and Deodorize: Paving the City in Late-Eighteenth-Century France›, in: ‹Assemblage No.31›, Cambridge 1996, pp. 6–15.
9 Nicola Gauger, ‹La Mecanique de Feu›, Paris 1749.
10 Robert Ritchie, ‹Suggestions for the better Ventilation of Vessels›, in: ‹Mechanics' Magazine, Museum, Register, Journal and Gazette, Volumes 38–39›, London 1843, pp. 422–423.
11 Ibid.
12 Jeanne Kisacky, ‹Breathing Room: Calculating and Architecture of Air›, in: Anthony Gerbino (ed.), ‹Geometrical Objects: Architecture and the Mathematical Sciences 1400-1800›, Switzerland 2014, p. 259.
13 Alain Corbin, Alain, ‹The Foul and the Fragrant / Odor and the French Social Imagination›, Cambridge 1986, p. 98.
14 Scott Drake, ‹The Architectural Antimephitic / Modernism and Deodorizations›, in: ‹Architectural Theory Review,2:2›, Sydney 1997, p. 23.
15 Alain Corbin, ‹The Foul and the Fragrant / Odor and the French Social Imagination›, Cambridge 1986, p .90.
16 Rodolphe El-Khoury, ‹Polish and Deodorize: Paving the City in Late-Eighteenth-Century France›, in: ‹Assemblage No.31›, Cambridge 1996, p .10.
17 Ibid.

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