

Air conditioner: A paradox

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Abstract. In this essay, I attempt to argue that a positive mental state can improve the quality of health as well as catalyze the healing process of illness through the practice of using air conditioners and opening windows in domestic spaces. To support this argument, I will discuss it in the context of global boiling through the framework of the phenomenon of sick building syndrome, modern architecture, bio/nature-based design, and microclimate. From this essay, I conclude that there is still a need for further research on the wise use of air conditioning to reduce its impact on the surrounding environment and how to create a microclimate in domestic spaces that can improve the quality of health of its users.

1 Sick building syndrome: From collective thought to indoor air quality problem

Global boiling is a current environmental issue that has a direct impact on physical and mental health [1]. Currently, the increase in global air temperature is approaching the limit set (limit of 1.5°C average temperature increase by 2030) in the Paris Agreement [2], which causes natural (passive) ventilation to be less efficient to make the indoor temperature comfortable to live in. The use of air conditioning has become a necessity to improve the comfort of indoor activities. However, the use of air conditioning is suspected to be the cause of the phenomenon of sick building syndrome (SBS). This phenomenon emerged along with the shift in demographics of workers who previously worked in factories to work in office buildings. Initially, more women experienced symptoms of the disease simultaneously [3], which could be an adaptation to changes in the work environment, but the exact origin of the cause is still unknown. SBS became a mysterious phenomenon between the reality of illness or mere suggestion [4]. This phenomenon has led to protests from feminists who highlight the latent dangers of the building materials used [3]. Everything that is done or happens collectively (in groups) will create an energy or force [5]. I see this collectivity of thought (suggestion) from the SBS phenomenon as one of the methods that can improve the quality of health (salutogenesis), prevent disease, and rehabilitation through the delivery of suggestions about positive things or placebo effects [6] carried out by everyone in the neighborhood including architecture.

Human mind is extraordinary. It can perform complex calculations to manifest things that were previously only abstract thoughts into reality. Humans can feel real pain just by simulating the symptoms [3,7,8]. This may be the cause of the SBS phenomenon in its time.

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However, nowadays many studies state that SBS is a real disease that results from exposure to toxic chemical substances produced from the building materials used [4,9-11]. This is exacerbated by the increasingly widespread use of air conditioning in buildings, which has now become a necessity to maintain the comfort of its users. The development of knowledge has led to a shift in thinking towards SBS, which was previously considered a collective phenomenon from the thoughts of women workers, to the real problem of air quality in buildings (IAQ). Kubota said that formaldehyde and VOC (Volatile Organic Compound) are two chemicals that cause MCS (Multiple Chemical Sensitivity) [11], which is part of SBS. However, it is possible that there could be other chemicals that are more influential. The presence of these chemicals is directly proportional to the practice of using air conditioning in buildings [11], so this practice could be the initial trigger for further investigation into IAQ.

2 Modern architecture and air conditioning

The SBS phenomenon emerged alongside the growing popularity of modern architecture [3]. Modern architecture eliminates ornamentation and decoration in buildings down to the most basic form. Modern architecture created a breath of fresh air for architectural practice, which was then dominated by ornate buildings. On the other hand, the absence of ornamentation was considered as a loss of meaning and personality of the building [7,9,12]. Day suggests that modern architecture creates a cold and sterile atmosphere, which has a negative effect on the mentality of its users [9]. This then raises the question, how is modern architecture created? Colomina suggests that modern architecture was heavily influenced by the diseases and technologies of the time [13]. The disease tuberculosis (TB) was the main trigger that encouraged the design of modern buildings to be oriented towards air and light, which at the time was considered a factor affecting the cure of TB [13]. However, according to Schrank [14], modern architecture creates a paradox in that it seeks to make interiors more natural by incorporating more light and air, but instead eliminates the 'natural form' of building exteriors that do not respond to the surrounding climate and environment [15]. The design of modern buildings then becomes all white, with lots of glass openings with wide terraces and balconies or rooftops. All building elements become functional without any ornamentation, like a machine with all its efficiency, a machine for living [16]. However, humans cannot be equated with machines. Humans tend to reflect the surrounding environment into themselves [6]. If we continuously interact with cold, meaningless spaces, how will it affect our health?

The sterile characteristics of modern architecture cannot be separated from the thoughts of its main figure, Le Corbusier, who was diagnosed with autism spectrum disorder (ASD) [17]. This mental disorder causes the sufferer to limit the stimulation they receive [17], as any type of variation in shape or color can be extremely distracting. In addition, ASD causes the sufferer to become less sensitive to their surroundings, be it people or the environment [17]. This makes modern architecture more function-oriented, regardless of the personal aspects of its users. Nowadays, especially in tropical climates, modern buildings with high ceilings and large glass openings (walls or skylights), create a new problem: heat. The effects of global boiling have increased the world's average temperature by 1.4°C [18], leading to extreme heat and drier winds [19]. This means that we can no longer rely on natural ventilation alone, so the use of air conditioning or other mechanical ventilation becomes a necessity to achieve the appropriate comfort level. Air conditioning requires a closed room with a ceiling that is not too high and glass openings that are not too many to work optimally. Modern buildings with all their openness make the use of air conditioning inefficient, causing environmental problems that have an impact on the global boiling [20]. This is an urgent problem that must be resolved immediately for the sake of human survival.

In addition to environmental issues, the use of air conditioning is also a major candidate for causing SBS [3,10,11,21]. Have you ever walked into an unventilated room in the morning when the AC has not been turned on? What do you feel? Air conditioning serves to filter and cool or warm the air in a closed room. This air is considered still air, as it is recirculated continuously until an attempt is made to open the vents (windows, doors, louvers, etc). This still air results in the accumulation of toxic chemical residues from building materials that can cause various diseases [22]. Modern building materials are heavily influenced by the Industrial Revolution [12,23], which makes natural building materials increasingly pushed aside. Industrial-derived materials often use chemicals that are harmful to health. Residual concentrations of toxic chemicals in still air can be reduced by opening windows or ventilation [21]. From the various negative impacts caused by air conditioning, it cannot be denied that we still need it in our daily lives to be able to achieve an appropriate level of comfort, especially in the current global boiling situation. Thus, what is a wise strategy in using air conditioning to create an architecture that is oriented towards people and the environment?

3 Beyond indoor air quality

Excessive heat conditions can lead to stress and depression [1]. Sustained stress and depression can manifest into physical illness [7,8], then in order to cure physical illness, it is the soul that must be cured first [9]. Architecture cannot cure directly, but it can build the mood of its users in a more positive direction [6]. A positive state of mind can prevent various diseases, even in an environment with poor air quality. Talking about air quality cannot be separated from the discussion about dust. Dust is everywhere and cannot be avoided, so it is necessary to make adjustments to live with dust [24]. So far, buildings tend to be designed to deflect or break the airflow aerodynamically, but Gissen [24] proposes a quite radical approach by directing the airflow into the building, including its pollution. The building becomes a living air filter with semi-permeable plant walls that can reduce pollution levels in the air. If combined with air conditioning or other mechanical ventilation, it could be the solution to today's health and global boiling problems.

Being in an air-conditioned space makes users move less [25]. This may be due to the comfortable temperature provided by air conditioning, which makes people feel more comfortable to sit or rest. People tend to move less when sick, so when healthy people choose to move less, they are simulating the behavior of sick people [7]. This creates a paradox, given that moving and being active is an important part of life [12,26,27]. So, how can we get people to move more in air-conditioned spaces? Several strategies can be used. First, we can design spaces that support physical activity by putting equipment or facilities in places that require a bit of walking to reach. Second, we can organize events or activities that require physical movement, such as light gymnastics or yoga. Third, we can adjust the temperature of the air conditioner so that it is not too cold. In this context, the use of air conditioning is important to create a comfortable atmosphere when moving.

4 Building as living organism

Global boiling makes architecture with many glass openings irrelevant. Special strategies are needed to cool buildings without having to use air conditioning excessively, one of which is by applying the principles of bio/nature-based design [27-30]. By applying this principle, the building becomes an active element that plays a role in creating a microclimate that supports the comfort of its users. Buildings are likened to living organisms, which move, breathe, consume, and express [31]. This design principle should also be combined with architectural

principles that support the active movement of its users. For example, window opening behavior is influenced by the temperature of the inside or outside space [31] and the use of air conditioning [21,32]. The longer the use of air conditioning, the less the frequency of opening windows [21], and vice versa. Window-opening behavior is very important in supporting our daily lives which cannot be separated from the use of air conditioning. Opening windows can reduce the toxicity of air and dust collected in the room [21,33], so that when turning on the air conditioner, the recirculated air becomes cleaner. In addition, opening windows can reduce the presence of house mites [10] which are usually camouflaged with dust. The use of air conditioning should be accompanied by frequent window opening behavior or the addition of mechanical ventilation that is directly connected to outside air (exhaust fans, turbine ventilators, etc.).

Excessive use of air conditioning also causes environmental problems related to energy. Space cooling is one of the world's largest energy consumers [20], so it should be used wisely. Opening windows in the morning and evening when the weather is not too hot can be an alternative to reduce the use of air conditioning. Window-opening behavior can also be a model for energy simulation in buildings [34], which determines how often air conditioning can be used. Opening windows is challenging due to its passive nature, creating a microclimate that is difficult to control. There are various strategies to control the microclimate, namely adjusting the spatial configuration of the building [35], the use of evaporative cooling systems on the facade [36] and green cover on the roof [37]. Microclimate management strategies in buildings for user health still need to be further researched as an effort to mitigate the effects of global boiling.

From this discussion, it can be concluded that the behavior of using air conditioning in domestic spaces is still a paradox. On the one hand, if used excessively and without control, the use of air conditioning can cause various diseases (SBS) and global crises. On the other hand, if used wisely with consideration of humans, the environment and good control, then the use of air conditioning can be a method to improve physical and mental health and minimize negative impacts on current global boiling conditions.

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