



Understanding domestic air-conditioning use behaviours: Disciplined body and frugal life



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ABSTRACT

Air-conditioning is more and more popularly used in domestic environments. The current understanding of using air-conditioning is based on technocracy of physiological thermal comfort, while ignoring socio-economic contexts. Taking Hong Kong as an example, this article aims to construct a non-technocratic understanding of air-conditioning uses in a relation to the housing status and demographics. This article argues that domestic air-conditioning is being used in order to dress appropriately and to forbid body sweating and odours during dining, sleeping and family gathering. The difference of air-conditioning use intensity is largely attributed to the disparity of economic status. Residents in public rental housing or with lower household incomes tended to have more frugal habits of using air-conditioning to rebate energy expenditure. Disciplined body and frugal life are proposed in this article to more critically expound the signification of air-conditioning in residential environments. A non-technocratic understanding of air-conditioning can bring forth better solutions to enhancing quality of life.

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1. Introduction

Facing global warming, particularly more frequent and elongated extreme climate events such as heat waves, air-conditioners have been used to mitigate heat-related illness and mortality (Kovats & Hajat, 2008; Semenza et al., 1996). Lack of air-conditioning might explain the high risk of climate change adaptation in most dwelling units, especially for urban poor households (Vandentorren et al., 2006). On the other hand, air-conditioning accounts for a significant portion of household energy consumptions and carbon emissions (IPCC, 2014). The role of air-conditioning in both climate change mitigation and adaptation makes it a salient issue in the research about human settlement in the new century.

The literature of air-conditioning mainly comes from building science and engineering, which can be found in a series of publications and standards by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), where the use of air-

conditioning is related to thermal comfort and the thermal comfort is the condition of mind that expresses satisfaction with the thermal environment. However, in recent years, thermal comfort is proved to be a socio-psychological adaptation rather than physiological reactions (Gou et al., 2013, Hitchings, 2009); people would feel comfortable at a larger range of temperature rather than the narrow temperature zone defined in those engineering standards (Liu, Yao, & McCloy, 2014). In other words, the hypothesis of thermal comfort cannot completely explain the use of air-conditioning. The technocratic understanding of air-conditioning just led to more and more engineering standards with little enhancement of quality of life. The elusiveness of thermal comfort engendered the research attention of air-conditioning shifted from engineering to sociology (Cooper, 1998). The study of air-conditioning is gaining its momentum in sociology where its popularity and widespread is related to modernization (Ackermann, 2010) and civilization (Parkhurst & Parnaby, 2008). Healy used Foucault's "disciplined body" to describe air-conditioning as a means of homogenising human bodies. He argued that natural bodily functions such as sweat and body odours were construed as negative and that the social risk of being stigmatizing by sweating and smelling is an important factor behind the use of air-conditioning in modern

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societies (Healy, 2008).

This research aims for a non-technocratic understanding of domestic air-conditioning, using Hong Kong as an example. Hong Kong is a humid subtropical city with extreme population density. Air-conditioning is necessary for people to get rid of sweating and odours. From home to workplace via public transits, restaurants and shops, air-conditioning is widely used in public and private spaces in Hong Kong. Air-conditioners have also become an important architectural feature in high-rise residential facades (Fig. 1). Air-conditioning use behaviours in residential environments had been well documented by local building science communities for predicting peak energy loads and improving building thermal performance. This article does not follow those studies arguing what air-conditioning use behaviours should be; this article, instead, is to find out what the air-conditioning use behaviours signify. Specifically, this article suggests that the understanding of air-conditioning use behaviours be related to housing statuses and demographics. To support the argument, the article provides a literature review to explore potential relationships between housing conditions and air-conditioning uses, and also presents a household survey to examine the relationships.

2. Housing sectors and air-conditioning in Hong Kong

In Hong Kong, housing supply comes from two main sources: firstly, private sector developments motivated by commercial incentive; and secondly, the public provision of welfare housing. The public housing sector further has two major sub-categories: public rental housing and subsidized-sale housing (Hong Kong Housing Authority, 2015). The composition of the three major housing systems is shown in Fig. 2. There are about 170 public rental housing estates and over 2 million people live in public rental housing. The occupants of public rental housing flats are low-incomes who rent the units at discounted rates. The public rental housing is managed by the Hong Kong Housing Authority. The Housing Authority also introduced various subsidized-sale public housing schemes to provide an alternative for public rental housing tenants to own a home. The public and private housing systems



Fig. 1. Typical high-rise residential façades with rhythmic air-conditioners (Photographed by the authors).

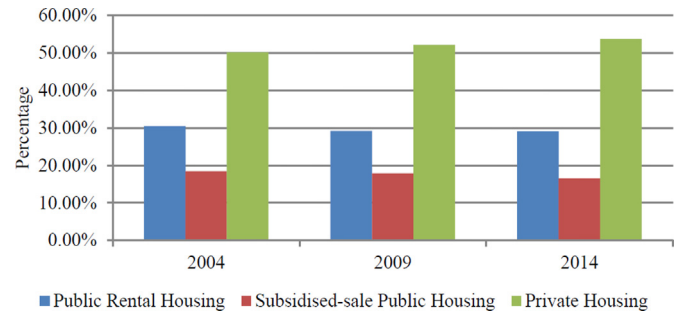


Fig. 2. Percentage of population living in the three major housing types. Source: Hong Kong Housing Authority, 2015.

evenly share the whole housing market in Hong Kong.

Although they are developed and managed by different capital, architecturally the three housing types all use a similar market formula: cruciform floor plan. This floor plan aims to maximize the saleable floor areas while to minimize the communal areas such as lifts, lobbies, fire stairs (Chan, Tang, & Wong, 2002). The cruciform is stringently applied in private housing; it has been further developed in public housing sector such as new cruciform, harmony one and concord. The cruciform and its ramified high-rise typologies have been examined for their environmental performance. They turned out to be poorly ventilated and climate-irresponsive (Lau, 2011). The condition is exacerbated by the fact that for privacy, most windows of these high-rise towers are kept closed or covered using opaque materials such as shades and curtains, which also blocked natural ventilation into the housing units (Lau, Gou, & Li, 2010). When taking into account the urban morphology, these high-rise towers cause “wall effect” which adversely impacts air circulation and aggravates the heat effect. Generally, natural cooling is inherently insufficient for high-rise living and dependence on air-conditioning is inevitable.

According to Government statistics, as shown in Fig. 3, air-conditioning accounts for the biggest portion of household electricity consumptions (EMSD, 2015). It is not surprising to see that the air-conditioning energy consumption in public rental housing sector is less than that in subsidized-sale public housing and private housing sectors; however, it is interesting to see that the air-conditioning energy consumption in subsidized-sale public housing sector is the same as that in the private housing sector. There are a number of household surveys which had been conducted to look at detailed residential air-conditioning use behaviours in Hong Kong. Lam (1993) found that in summer, air-conditioners in living rooms were operated mainly during the afternoon and evening while the operating time of air-conditioners in bedrooms were during evening and at night. Tso and Yau (2003) found that electricity loading patterns significantly differed between summer and winter. In general, the average electricity consumption was much higher in summer than in winter, especially during nighttime, due to the extensive use of air-conditioners during the summer to cool temperatures while sleeping. These surveys also confirmed that energy consumption on air-conditioning represented nearly two-thirds of the total electricity consumption during summer months. For a typical household, the electricity consumption during summer could be more than twice that during winter. Wan and Yik (2004) found that the majority of flats in private residential buildings had been equipped with an air-conditioner in every living and dining room and bedroom. The electricity consumption patterns of residential units would be significantly affected by the seasonal utilisation of air-conditioners and electric water-heaters in both public and private housing. Lin and Deng (2006) pointed out

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