Environmental psychology and sustainability in high-rise structures

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Abstract

This paper addresses the human elements of sustainable design in urban high-rise buildings. While a number of technical developments have allowed for the minimization of resource consumption, little research has addressed the response of occupants to such facilities, or the degree to which success in reaching sustainability goals is dependent on user behavior. This paper reviews research in related areas and suggests ways in which social, psychological and behavioral issues may be important to sustainable design, as well as how ways attending to psychological needs can improve the success of meeting these and other goals. Social psychological and applied behavior analytical approaches are reviewed as ways to respond to conservation and recycling goals. The psychological and physiological benefits that green buildings confer on their occupants are also addressed, as are areas for future research, and steps that the building industry can take to develop more holistic and sustainable building practices that incorporate occupant behavioral needs.
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1. Introduction

Increasingly, developers are seeking to construct more sustainable buildings, including mega-structures like the much anticipated redevelopment of the World Trade Center [1]. While there is increasing technological knowledge on how to accomplish this goal [2–4] there is still limited research on the relationship between these improvements and individual building users and occupants. Since social issues are essential components of sustainable development, it is

important to understand the relationship between technological advances in sustainable structures and the behaviors of, and impacts, on building users.

The first recognized definition of sustainable development was offered by the Brundtland Commission in 1987 as that which "meets the needs of the present without compromising the needs of the future" [5]. Sustainability was further conceptualized and expanded at the international Earth Summit conference in Rio de Janeiro in 1992, to integrate concerns for environmental, economic, and social well being. The focus of this paper is on sustainability in the context of the built environment with primary emphasis on consumption of physical resources, wherein a sustainable building is one that improves occupant health and performance, minimizes energy and material consumption, and stimulates a healthy ecosystem.

There is limited research on human behavioral and social responses to issues of sustainability in buildings in general, and even less so for high-rise buildings, which for the purpose of this paper are limited to structures over 10 or more stories high [6]. Even so, trends over the last century suggest increased construction of such edifices. The world-wide phenomenon of migration from agricultural to urban communities [7] and increased awareness of environmental problems related to urban sprawl [8] provided the impetus for development of large scale urban projects. This tendency towards high-rise buildings is supported by technological advancements that have made their construction easier and less costly.

Traditionally, high-rise buildings consume a great number of resources. These massive structures are dependent on large quantities of building materials during construction, require considerable amounts of energy to operate, and produce a great deal of waste when they reach the end of their life cycle and are demolished. Over 75% of the energy consumption in high-rise buildings is allocated for heating, ventilation, and air conditioning (HVAC) [6, p. 200]. In the past, the low cost of energy and technological advancements in lighting and HVAC have discouraged architects and building engineers from making more use of passive temperature control devices, such as operable windows and shading techniques. But current concerns about the rising cost of energy, limits on availability of potable water, and awareness of problems with material use and waste disposal are likely to influence designers to incorporate more sustainable elements into high-rise structures.

While there is increasing attention paid to sustainable building techniques, there has been relatively little discussion about the psychological and behavioral aspects of sustainability and how people interact with these structures. This paper will discuss social, psychological and behavioral issues that need to be addressed in high-rise facility management, as well as the potential for sustainable buildings to ameliorate some of the problems in those areas traditionally associated with high-rise buildings. It concludes by identifying future research topics and steps that the building industry can use to develop more holistic and sustainable building practices.

2. Behavioral needs in sustainable buildings

Some of the oft-cited ecological benefits of green buildings are dependent on the ability to correctly predict user behavior. All occupied buildings are designed around explicit or implicit assumptions about user behaviors, decisions and responses. From an environmental psychological perspective, buildings are physical forms that, in Bechtel's terms, 'enclose behavior'. That is, buildings provide facilities and shelter from the elements to support human activities. They are designed to provide for human behavior, psychological, and social needs. Whether or not they are successful depends in large part on the degree to which designers accurately understand and predict what activities are required and likely to occur, and their