THE IMPLICATION OF ARCHITECTURE ON PUBLIC HEALTH

Ogbuanu Achara-ugo Onyebuchi

Department of Architecture
Rivers State University, Port Harcourt
E-mail: acharabuchi@gmail.com

ABSTRACT

The impact of architecture to sustained health was assessed employing secondary source of data. It was revealed that obesity, heart conditions, High Blood pressure has quickly become the largest contributors to most health related issues. The issue facing society is not only how to combat and address the concerns of preventable chronic diseases, but to also find ways to improve health for an individual and the collective through architecture, because architecture plays a critical role in shaping the qualities of our environment and have the power to restore and promote solidarity, mental and physical health and be a source of happiness. This study examined the link between architecture, health and well- being and highlights the profound effects that the built environment has on public health with its focus on sustaining improved health. By moving beyond building designs with optimizing single parameters such as temperature and humidity, to more holistic approaches that take their cues in health-supporting human behaviors. As a minimum, designers should ensure that direct physical health parameters (e.g. air quality) achieve a level that is considered 'good enough' to avoid ill health. The fact that there are numerous strategies related to different settings, it is important to design adaptable environments.

Keywords*: Architecture, Sustained Health, Physical Health, Well-Being, Health. Public Health*

INTRODUCTION

Architects play a critical role in shaping the qualities of our environment; they work in collaboration with end users and their needs and ambitions, and they have the power to restore and promote solidarity, mental and physical health and be a source of happiness. Planning decisions about factors such as density of

communities, presence and size of parks, land-use mix, height and size of residential structures, food store location, and how roads are laid as well as factors such as traffic density, air and water quality are laid out, affects the physical and psychological health of people in all ages. Most of the major health problems plaguing the Nigerian adult population today— from psychological distress to heart disease to diabetes, high blood pressure—have significant environmental causes. Having natural areas nearby promotes well-being. Access to or views of the natural environment improve cognitive functioning and improve recovery from surgery and illness. People who live near parks and open space are more physically active. (Wells, 2011) In fact, older, urban residents who have places to walk and access to parks and tree-lined streets live longer. Trees and natural areas may bolster a sense of community by drawing people together and enhancing social connections.

The characteristics and quality of housing, directly affect people's physical and mental health. A home that is cold and damp or has allergens may cause respiratory illnesses and asthma in the residents (Shaw, 2004; Wigle, 2003). The height and size of housing also has health effects on residents—high-rise housing is associated with psychological stress, particularly among low-income mothers of young children (Evans, et al., 2003). Children who lived in 14-storey public housing were found to have greater behavioral problems than children living in three-storey public housing (Saegert, 1982). Social isolation may be one reason for this, because parents are less likely to let their kids play outside if they live high up in a large building (Kim, 1997). And, finally, crowding has detrimental effects on both mental and physical health (Evans, 2001). When many of these risk factors exist together in a single neighborhood, they are likely to have serious impacts on the mental and physical health of the people. To truly enhance human well-being, building design needs to move beyond optimizing single parameters such as temperature and humidity, to more holistic approaches that take their cues in health-supporting human behaviors. Based on the Five Ways to Well-Being that have recently been established by scientists, this article outlines some essential rules of thumb that designers can follow in order to nudge building users into a healthier way of

living. The design of our built environment affects our health and well-being, and can have long-term implications for quality of life. When we discuss well-being in buildings, it is more important to incorporate a wide range of both quantitative and qualitative health considerations rather than to focus on single, narrowly defined criteria. Such 'silo thinking' tends not to aid good design (perfectionism can be crippling) and often different criteria are in tension. An alternative approach is to determine 'good enough' strategies which increase diversity and adaptability, and that are user-centered. This is not to deny the potentially chronic health impacts of poor indoor environmental quality on certain sectors of the population (i.e. large impact for a small population), but rather to balance and complement this with strategies to improve well-being for the wider population (i.e. modest improvement for a large population). The structure of this article is divided into four sections. The first section reviews conceptual issues as related to the topic. The second section reviews the spatially relevant definitions of well-being and their relationships to health. The third section draws on research to define the implications and opportunities for architecture. Finally, the last section provides rules of thumb and architectural propositions that exemplify the findings.

Conceptual Issues

Basic conceptual issues relevant to this discussion include; Architecture, health, public health, well-being, housing, housing policy, planning

Architecture

Wikipedia (2011): Architecture is from the Latin word *architectura*, a word used to describe the job of an architect. The ancient Greek *arkhitekton* was the chief builder or master technician of all craftsmen and artisans. The word *architecture* can have many meanings. Depending on the context, architecture can refer to:

i. The art or science of building; *specifically:* the art or practice of designing and building structures and especially habitable ones

ii. Formation or construction resulting from or *as if* from a conscious act *the architecture of the garden* a unifying or coherent form or structure *a novel that lacks architecture*

iii. Architectural product or work *buildings that comprise the architecture of the square*
iv. A method or style of building *Gothic architecture*
v. The manner in which the components of a computer or computer system are organized and integrated *different program architectures*

An Architect:

Is someone who plans, designs, and reviews the construction of buildings. To *practice architecture* means to provide services in connection with the design of buildings and the space within the site surrounding the buildings, that have as their principal purpose human occupancy or use. Etymologically, *architect* derives from the Latin *architectus*, which derives from the Greek (*arkhi-, chief +* tekton*, builder),* i.e., **chief builder**.

Professionally, an architect's decisions affect public safety, and thus an architect must undergo specialized training consisting of advanced education and a *practicum* (or *internship*) for practical experience to earn a license to practice architecture. Practical, technical, and academic requirements for becoming an architect vary by jurisdiction

Health:

Is the level of functional and metabolic efficiency of a living organism. In humans it is the ability of individuals or communities to adapt and self-manage when facing physical, mental, psychological and social changes. The World Health Organization (WHO) defined health in its broader sense in its 1948 constitution as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." This definition has been subject to controversy, in particular, as lacking operational value, the ambiguity in developing cohesive health strategies, and because of the problem created by use of the word "complete". Other definitions have been proposed, among which a recent definition that correlates health and personal satisfaction. Classification systems such as the WHO Family of International Classifications, including the International Classification of Functioning, Disability and Health (ICF) and the International Classification of Diseases (ICD),

are commonly used to define and measure the components of health.

Public Health:

This refers to "the science and art of preventing disease, prolonging life and promoting human health through organized efforts and informed choices of society, organizations, public and private, communities and individuals." It is concerned with threats to health based on population health analysis. The population in question can be as small as a handful of people, or as large as all the inhabitants of several continents (for instance, in the case of a pandemic). The dimensions of health can encompass "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity," as defined by the United Nations' World Health Organization. Public health incorporates the interdisciplinary approachesof epidemiology, biostatistics and health services. Environmental health, community health, behavioral health, health economics, public policy, mental health and occupational safety and health are other important subfields. The focus of public health intervention is to improve health and quality of life through prevention and treatment of disease and other physical and mental health conditions. This is done through surveillance of cases and health indicators, and through promotion of healthy behaviors. Examples of common public health measures include promotion of hand washing, breastfeeding, delivery of vaccinations, suicide prevention and distribution of condoms to control the spread of sexually transmitted diseases.

What Is Well-Being?

As defined by Wikipedia, (2011), wellbeing, welfare or wellness is a general term for the condition of an individual or group, for example their social, economic, psychological, spiritual or medical state; a high level of well-being means in some sense the individual or group's condition is positive, while low well-being is associated with negative happenings. In philosophy, the term 'well-being' (and 'welfare', 'utility', etc.) refers to the manner in which an individual's life manifests desires, objectives, and needs—among myriad more diverse variables—and how these affect the individual's perspective.

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A recent study of people's perceptions of well-being by Schickler found three key domains:

- Feeling—experiencing positive emotions and sensations, feeling happy and optimistic
- Doing—being actively engaged, moving toward goals, participating in decision making, and experiencing a sense of control
- Being—a state of quiescence, being reflective, or experiencing peace and quietness (Schickler, 2005)

These domains are consistent with the "positive" psychology movement that focuses on the antecedents and consequences of well-being and happiness (Seligman and Csikszentmihalyi, 2000). The positive psychology movement emerged in the 1990s with the growing realization that psychologists knew much about mental and behavioral pathologies, but relatively little about positive behavioral and emotional experience that underlie quality of life and sense of well-being.

The arena of positive psychology is highly relevant to patients, staff, and visitors in healthcare settings. As noted before, the links between health and sustainable design currently focus on improved physical health through improved indoor air quality and reduced exposure to airborne biological or chemical substances. Much less attention is paid to how sustainable design can support positive mental, emotional, and social experiences that underlie concepts of well-being. For design applications, two questions need to be addressed:

    (i)   what experiences underlie a sense of well-being, and
    (ii)   what features and attributes of the environment support these experiences?

Housing:

Listokin et al. (2007) have defined housing as a permanent structure for human habitation. It is also referred to as the house and defined as a home, building or structure that is a dwelling or place for habitation by human beings. The term "house" includes many kinds of dwellings, ranging from rudimentary huts of nomadic tribes to free standing individual structures (Wikipedia, 2011). Williams (2007) refers to it as a dwelling place, constructed as a home for one or more persons. Godwin (1998) defined it as

"the space that we can call our own, that gives us privacy and shelters us from the weather and intrusions of unwanted people". Housing in all its ramifications is more than mere shelter. It embraces all the social services and utility that goes to make a community or neighbourhood a live-able environment. (FGN, 1991; Omoniyi and Jiboye, 2009). Housing has become a critical component in the social, economic and health fabric of every nation. Its history is inseparable from the social, economic, cultural and political development of man (Listokin et al., 2007). As a unit of environment, it has a profound influence on the health, efficiency, social behavior, satisfaction, productivity and general welfare of the individual and community. It reflects the cultural social and economic values of a society as it appears the best physical and historical evidence of civilization in a country and a reliable measure or indicator of economic development (Jiboye, 2009).

Housing Policy:

As defined by Wikipedia, (2011), a policy is a principle or rule to guide decisions and achieve rational outcome. It may also refer to the process of making important organizational decisions, including the identification of different alternatives such as programs or spending priorities, and choosing among them on the basis of the impact they will have. Policies can be understood as political, management, financial, and administrative mechanisms arranged to reach explicit goals. Agbola and Alabi (2000) also defined it as a plan of action, a statement of aim and ideas. Housing policy is thus a guideline provided by government which is aimed at meeting the housing need and demand of the people through a set of appropriate strategies including fiscal, institutional, legal and regulatory frameworks (Agbola, 1998). A housing policy therefore provides a guide which delimits action and sets goals but does not necessarily specify any defined strategies for achieving the goal other than broad strategies. It establishes guidelines and limits for discretionary actions by individuals responsible for implementing the overall plans of action (Olatubara, 2002). Duruzoechi (1999) noted that some housing policy decisions (written or implied) express the overall past work of government while others are goal statement or prescription of elemental rules for the conduct of personal or

organizational affairs. Policies are thus well reasoned, carefully articulated and presented documents. (Olatubara, 2002). Housing policy is essentially necessary as a guide or control on the various actors in the housing sector. The main objectives of housing policy according to Duruzoechi, (1999), are to obtain the optimum use of existing housing resources in other to ensure adequate housing for the people, guide the location of new housing, and be responsive to the housing needs of special people.

Planning

As defined by Wikipedia, (2011), (also called **forethought**) is the process of thinking about and organizing the activities required to achieve a desired goal. It involves the creation and maintenance of a plan, such as psychological aspects that require conceptual skills. There are even a couple of tests to measure someone's capability of planning well. As such, planning is a fundamental property of intelligent behavior.

Also, planning has a specific process and is necessary for multiple occupations (particularly in fields such as management, business, etc.). In each field there are different types of plans that help companies achieve efficiency and effectiveness. An important, albeit often ignored aspect of planning, is the relationship it holds to forecasting. Forecasting can be described as predicting what the future will look like, whereas planning predicts what the future should look like for multiple scenarios. Planning combines forecasting with preparation of scenarios and how to react to them. Planning is one of the most important project management and time management techniques. Planning is preparing a sequence of action steps to achieve some specific goal. If a person does it effectively, they can reduce much the necessary time and effort of achieving the goal. A plan is like a map. When following a plan, a person can see how much they have progressed towards their project goal and how far they are from their destination.

Health in Buildings:

Because we breathe without conscious effort, we spend little time thinking about what enters our systems with those breaths. We do not see, and only sometimes smell, the chemicals and

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particulates that endanger our health. Yet indoor air quality is not a primary focus of contemporary building design. The U.S. Environmental Protection Agency (EPA) estimates that Americans spend almost 89 percent of their time indoors (at home and at work), 6 percent in vehicles, and only about 5 percent outdoors. They further tell us that the air indoors is about 2 to 5 times more concentrated with chemical pollutants than the air outdoors, with the result that we are being exposed to high levels of chemical concentrations for the vast majority of our lives. Our bodies, not designed for this, are responding with health afflictions such as

- Sick building syndrome (short-term health effects with cold like symptoms that cannot be traced to specific pollutant sources),
- Building-related illnesses (diagnosable illness whose symptoms can be identified and whose cause can be directly attributed to airborne building pollutants), and
- Multiple chemical sensitivity (a condition in which a person reports sensitivity or intolerance to a number of chemicals and other irritants at very low concentrations).

Indoor air quality is dependent on a number of factors, including the quality of the outside air that we bring into the building; the chemical emissions from the materials, furnishing, and equipment that we place in our buildings; the efficacy of the ventilation systems that we use to purge the indoor air; the activities of the building occupants; and the long-term maintenance of the buildings and their contents. These factors contribute volatile organic compounds; microbial organisms and microbial volatile organic compounds from mold; semivolatile organic compounds from fire retardants, pesticides and plasticizers; inorganic chemicals such as carbon monoxide, nitrogen dioxide, and ozone; and particulate matter generated outdoors by fuel combustions and indoors by occupant activities and equipment.

Factors Influencing the Built Environment

With human factors in mind, there are several aspects of the built environment that should be considered. In a review of the literature by Henriksen and colleagues, the following design elements were identified as critical in ensuring patient safety and quality care, based on the six quality aims of the Institute of

Medicine's report, *Crossing the Quality Chasm: A New Health System for the 21st Century.*

Patient-centeredness, including
- using variable-acuity rooms and single-bed rooms in hospitals
- ensuring sufficient space to accommodate family members
- enabling access to health care information
- having clearly marked signs to navigate the hospital

Safety, including
- applying the design and improving the availability of assistive devices to avert individual falls
- using ventilation and filtration systems to control and prevent the spread of infections
- using surfaces that can be easily decontaminated
- facilitating hand washing with the availability of sinks and alcohol hand rubs
- preventing patient and provider injury
- addressing the sensitivities associated with the interdependencies of care, including work spaces and work processes

Effectiveness, including
- use of lighting to enable visual performance
- use of natural lighting
- controlling the effects of noise

Efficiency, including
- standardizing room layout, location of supplies and medical equipment
- minimizing potential safety threats and improving patient satisfaction by minimizing patient transfers with variable-acuity rooms

Timeliness, by
- ensuring rapid response to patient needs
- eliminating inefficiencies in the processes of care delivery
- facilitating the clinical work of nurses

Equity, by
- ensuring the size, layout, and functions of the structure meet the diverse care needs of patients

There have been five other significant reviews of the literature relating to the physical environment and patient outcomes.

Nelson and colleagues identified the need to reduce noise pollution and enhance factors that can shorten a patient's length of stay (e.g., natural lighting, care in new/remodeled units, and access to music and views of nature); according to their study, patients can benefit from the skillful utilization of music and artwork. Ulrich and colleagues found research that demonstrated that the design of a hospital can significantly improve patient safety by decreasing health care associated infections and medical errors. They also found that facility design can have a direct impact on patient and staff satisfaction, a patient's stress experience, and organization performance metrics. Three other reviews found that hospital design, particularly when single-bed rooms are employed, can enhance patient safety and create environments that are healthier for patients, families, and staff by preventing injury from falls, infections, and medical errors; minimizing environmental stressors associated with noise and inefficient room and unit layout; and using nature, color, light, and sound to control potential stressors

Relationship between Well-Being and Health:

The World Health Organization now defines health not as the absence of ill-health but as "a state of complete physical, mental and social well-being". The definition of health has been changing and now includes an awareness of the interrelationships between social and psychological, as well as medical, factors. The way in which an individual functions in society is seen as part of the definition of health, alongside biological and physiological symptoms. Health is no longer simply a question of access to medical treatment but it is determined by a range of factors related to the quality of our built environment.

This wider definition of health comes at a time of increasing pressures on health services as a result of an ageing population, increasing obesity, rising mental health problems and higher expectations. Thus, the narrow focus on individual symptoms and medical treatment is no longer sufficient or sustainable, and a more holistic appreciation of the spectrum of health-related considerations, including the prevention of ill-health, is timely. This approach sees "health and well-being as interdependent; it holds 'prevention' as important as 'cure', and looks for long-term solutions rather than more immediately attainable treatments".

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Staying healthy in your home and in your community is the way to limit the increasing pressure on health services, and thus designing the home, neighborhood and work environment to improve health and well-being is an opportunity that presents itself.

Health is referred to in this context in more conventional terms – as the absence of disease – and typically measurable in terms of symptoms such as body temperature or blood chemistry. Comfort is widely understood to be a "condition of mind which expresses satisfaction" with the environment– whether thermal, visual, acoustic, etc. – and thus incorporates both qualitative psychological considerations (e.g. expectation, control) and quantitative physical parameters (e.g. temperature, air movement). Happiness colloquially refers to emotions experienced, potentially ranging from contentment to joy. Happiness is therefore primarily a subjective and qualitative consideration.

One key challenge is the quantification of health and well-being, and thus the assessment of the overall health performance of design. At one end of the spectrum, physical ill health is typically identifiable and measureable in terms of the symptoms and causes. For example, air quality and its impact, particularly on vulnerable occupants (e.g. those with lung conditions, the young and the old), can be quantified, and even treatments of both the occupants and the buildings can be prescribed (e.g. improved ventilation, the removal of offending materials, design interventions to prevent mould growth, etc.). Although subjective assessment of air quality, particularly related to odor, can offer useful insights, often health-threatening indicators can only be measured. Specific criteria and design strategies to tackle chronic physiological health problems can be defined, and there is a wealth of expertise to support this. At the other end of the health and well-being spectrum is mental well-being or happiness. As we move from the deterministic-medical to the subjective psychological end, the common perception is that the emphasis changes from quantitative to qualitative. However, it is now evident that even within the sphere of the subjective parameters there are emerging methodologies and indicators that can be

defined. For example, in the field of thermal comfort there has seen a development from narrow and precise physiological comfort theory, based on the seminal work of Fanger, to a more holistic understanding that has led to the adoption of adaptive comfort theory. Similarly, health research has extended from the treatment of symptoms to incorporate a wider and more holistic appreciation of well-being of the population.

The notion of well-being consists of two key elements: *feeling good and functioning well*. Feelings of happiness, curiosity and engagement are characteristic of someone with a positive sense of themselves. Having positive relationships, control over your own life and a sense of purpose are all attributes of functioning well. International evidence has recently been gathered to measure well-being, demonstrating that this field has now emerged as a rigorous discipline. Recent research has demonstrated connections of key physical design characteristics with the Five Ways to Well-Being (Connect, Keep Active, Take Notice, Keep Learning and Give), which have been associated with positive mental health. Based on these findings, the following paragraphs reveal how the provision of local urban and domestic resources can impinge on the five healthy behaviors. This supports current theory and research, which shows that a sufficient quantity and quality of diverse environmental, social and physical resources can influence human cognition, which, in turn, can increase the healthy behaviors of the wider population.

Architecture and Health
The relationship between architecture and health has historically received little attention, beyond the design requirements of healthy buildings. Recent work has changed this and has established a more holistic awareness of the role of architecture in health. The emphasis has been on ill health as a result of the effects of environmental characteristics such as overcrowding, noise, air quality and light. These effects are typically described as direct (i.e. consequences on physical and mental health) as well as indirect (e.g. through social mechanisms). However, rather than focusing on ill health, the definition and study of well-being has been emphasizing the behaviors that support a 'flourishing' population. It is the built-environment characteristics that support

such positive behavior, which is a key point of discussion here. The science of well-being is a relatively recent area of enquiry. However, the UK Government's 'Foresight' project, related to well-being, provides the critical mass of evidence that led to the definition of the Five Ways to Well-Being mentioned above. These represent the key behaviors that have been shown to relate to improved well-being. Each behavior is associated with subjective well-being. Land-use planning, such as zoning, often influences community attributes such as soil contamination, safety of drinking water, traffic density, and water, air, noise, and light pollution. For example, studies show that noise affects reading skills in children, elevates blood pressure, and increases stress hormones. Residents who live in neighborhoods where they must depend on cars for transportation have reduced physical activity and increased obesity rates.

Planning decisions that influence the location of supermarkets, fast-food eateries, farmers markets, and convenience stores can profoundly affect people's diets and their health. People who live in a neighborhood with a supermarket are more likely to eat the recommended amount of fruits and vegetables. Further, wealthier neighborhoods have more supermarkets than do poorer neighborhoods, and poor communities have more places to buy and drink alcohol.

The characteristics and quality of housing directly affect people's physical and mental health. A home that is cold and damp or has allergens may cause respiratory illnesses and asthma in the residents (Shaw, 2004; Wigle, 2003). The height and size of housing also has health effects on residents—high-rise housing is associated with psychological stress, particularly among low-income mothers of young children (Evans, et al., 2003). Children who lived in 14-story public housing were found to have greater behavioral problems than children living in three-story public housing (Saegert, 1982). Social isolation may be one reason for this, because parents are less likely to let their kids play outside if they live high up in a large building (Kim, 1997). And, crowding has detrimental effects on both mental and physical health (Evans, 2001). When many of these risk factors exist together, they are likely to have even stronger impacts on mental and

physical health. (Wells 2011) in Her research has shown that having nature close to a home protects the psychological well-being of children. And the impact is strongest for children with the highest levels of stressful life events. In addition, having green space around the home boosts their cognitive functioning. In a study of 337 children in five rural upstate New York communities in grades 3 through 5, Wells and Evans (2003) found that the impact of life stress and adversity was lower among children who lived close to nature and vegetation than among those with little access to natural settings. To gauge how the children were dealing with stress, Wells used parents' reports of their children's psychological distress and children's own ratings of their feelings of self-worth, using standard measurement tools.

Rules of Thumb for Design:

It is evident from the available research that there are no singular or universal design solutions to ensure that every health parameter is optimized, and that the inhabitants and wider population will flourish. As a minimum, designers should ensure that direct physical health parameters (e.g. air quality) achieve a level that is considered 'good enough' to avoid ill health, whilst not impinging on the opportunity for design to integrate wider wisdom and to nudge occupants into positive health behaviors. The fact that there are numerous strategies related to different settings and users suggests that it is important to design adaptable environments. This is particularly relevant in the context of demographic change and climate change, but also changes in work, life styles and the availability of new technology. Design should thus be responsive to user needs, behaviors and requirements, offering users a freedom of choice and control over their environment. A number of rules of thumb emerge and are grouped below into key themes:

Neighborhood and design:

There is a large amount of research related to the design of neighborhoods that supports health and well-being. Some of the design characteristics that emerge consistently are:

Moving Access:

As we lead increasingly sedentary lifestyles, encouraging a modest level of activity becomes important in order to improve cardiac health, counteract obesity and maintain general fitness (Keep Active). The recommended level of activity is at least 30 minutes of moderate exercise (3 Mets, cycling or brisk walking) on five or more days per week, or 20 minutes of vigorous physical activity (6 Mets, jogging or gym exercises) three or more days per week. Although gyms have become increasingly popular for some (and can also support Connect), achieving improvement in fitness for all is the main goal. Moving up and down stairs is a simple and effective solution, which counters the tendency for choosing a bungalow house for retirement (resulting in reduced exercise at a time of life when it is important to stay active, and ending up with what is colloquially referred to as 'bungalow knees'). Three-storey homes are likely to increase personal energy expenditure and can contribute to increased housing density, which in turn leads to other sustainable design opportunities. Research on human energy expenditure in buildings has revealed that typical office workers are less physically active away from work, with an overall activity level marginally below the recommended levels. Thus even modest increases in domestic and neighbourhood activity levels through design can be health-enhancing. Climbing one floor by stairs accounts for 3.3% of extra daily energy expenditure, and getting up 20 times from a seated position equates to about 10% of a healthy daily total of metabolic activity. Some stealthy design strategies to Keep Active are suggested: users, it is clear that all housing design must accommodate this. There is numerous guidance documents related to this, but some key considerations include:

a . Making circulation an enjoyable experience and provide rewards for the movement (avoid boring corridors, aim for good natural light, views, opportunities for spatial variation and encounter (Connect), use art, etc.).

b. Personal energy expenditure, to encourage movement (put the living space on a different level from the kitchen/dining area, don't have toilets on every floor level).

Conversely, for those who are physically disabled or are wheelchair users, it is clear that all housing design must

accommodate this. There are numerous guidance documents related to this, but some key considerations include:

    i. Accessible dimensions for circulation areas (which can contribute to a more generous experience for all)

    ii. Level access thresholds throughout (valuable for families with prams).

    iii. Window sill heights to enable views out when seated (views out, especially of natural scenes, are conducive to well-being).

    iv. Electrical sockets not too low, and worktops, handles, thermostats and light switches not too high (allowing all users control over their home environment).

    v. The potential for a lift to be installed and/or the adaptation of the home for single-floor living (bedroom and bathroom on the ground floor – also useful for temporary ill health and privacy if designed well). Such design considerations should also incorporate strategies to ensure that partners and carers of wheelchair users are encouraged to remain active.

Eating

Poor nutritional eating habits can lead to obesity and related health problems. The preparation and cooking of (fresh) food can become a more social activity if the kitchen is designed to enable interaction with other members of the household or community. At a community level, the provision of neighborhood allotments to grow fresh food is recognized as enhancing health and well-being due to fresh produce, physical exercise and social interaction. Furthermore, the reduced reliance on the car for shopping and the avoidance of packaging and food miles, reduce the energy and other resources required, thus improving environmental sustainability. With respect to the design of the home, the strategy is to create a sense of theatre related to cooking, and enabling audience participation through the design of accessible worktops and adjacent seating. To support communal eating, and the social interactions that result, the dining area/table should be in close proximity to the kitchen. Conversely, the lounge/TV area should be less accessible from the kitchen (potentially upstairs to encourage physical exercise),

limiting the temptation for TV dinners but also providing potential separation in terms of noise, odors and pollutants.

Indoor Environmental Quality:

Light: Natural light has a range of advantages over electric light, including its variability and efficiency, and creating an awareness and link to the outside conditions. Apart from being a free source of light within a home, and thus part of an energy efficient strategy, it will animate spaces and can create drama and diversity. Furthermore, the benefits to physical health are now well understood and can counteract seasonally affective disorder (sad). However, over illumination can be detrimental to comfort and disrupt sleep. A number of rules of thumb emerge:

 a. Orient rooms used in the morning (bedrooms and kitchen) to the morning light to provide a dose of light to stimulate the circadian rhythm (sad light-box therapy typically prescribes 10,000 lux for 30 minutes in the morning).

 b. Main habitable rooms should receive 'good' daylight (above 3% average daylight factor), and a key family room should have access to direct sunlight for at least 2 hours per day.

 c. Windows with high head heights provide more access to daylight by an increased sky view (which is particularly important in dense neighborhoods) and better daylight distribution in the room.

 d. Bedrooms in particular should have effective blackout options to support good sleep patterns, for example in the form of thermal shutters (for cold periods) and/or with adjustable louvers (for secure night time ventilation in warm conditions).

 e. Personal control over the amount of daylight provides welcome opportunities for the inhabitant to adjust conditions to suit their patterns of use, and results in a greater sense of satisfaction with their environment. Windows should offer a range of conditions (e.g. light

that is from above, the side, direct, diffuse, and adjustable by shutters, louvers and blinds).

Temperature: as with light, the thermal design strategy should create both comfortable and stimulating conditions that can exploit the climatic conditions to improve energy efficiency. The body senses the thermal environment not just in terms of the air temperature, but also radiant conditions (e.g. sunlight), air movement (e.g. natural ventilation) and the conduction of heat via surface materials (wood feels warm, stone feels cool). Each of these thermal characteristics is a function of, and an opportunity for, design: under: as with other aspects of environmental design, acoustic conditions can be used to create opportunities to support user needs and preferences. Although noise can cause stress, acoustic contact with the neighborhood and nature can be valuable. Similarly, within the home there are places and moments when acoustic privacy is welcome, although complete acoustic separation is rarely required.

a. Exploit solar radiation to create sunny places to be on cool days, such as window seats (with warm surfaces) and sun spaces. Use heavyweight materials to absorb and retain the warmth.

b. To support activities such as music and indoor exercise without disturbing others, acoustic separation to some spaces is valuable.

c. Design open able windows so that people have the opportunity to connect and talk with passing neighbors.

d. In order to exploit natural ventilation in an urban environment, particularly at night, and when quiet conditions for learning or sleeping are sought, the design should incorporate noise-attenuated air paths.

e. Separate noise-creating sources – such as washing machines and dishwashers – from living and study spaces to support social and learning activities.

Design quality: there are a number of other design characteristics that impact on the Five Ways behaviors; these are briefly outlined below:

a. The color of our environment, such as interior walls, can impact on our learning behavior and, in certain spaces, can be used to support learning. Research has concluded that "red enhances performance on a detail-oriented task [such as doing homework], whereas blue enhances performance on a creative task [like art of social debate]

b. Ceiling heights can play a role in our social perspective and ability to focus. Recent findings show that when people are in a low-ceilinged space, they are better at focused tasks, such as studying or reading. More generous spaces prime us to feel free, which tends to lead people to engage in more abstract styles of thinking; they are better able to take a wider perspective and see what aspects are in common, particularly appropriate for social gathering spaces.

c. The form of space influences our sense of comfort and beauty. Curved forms are perceived as pleasant and in recent experiments, "participants were more likely to judge spaces as beautiful if they were curvilinear than if they were rectilinear". The researchers went on to conclude that this "well-established effect of contour on aesthetic preference can be extended to architecture.

d. Thus blue, tall and curvilinear spaces, with views of the blue sky, are more likely to be pleasant, sociable and creative environments. Conversely, red, low-ceilinged, rectilinear environments are more likely to encourage focus, concentration and study.

CONCLUSION

Whether people are healthy or not, is determined by their circumstances and environment. To a large extent, factors such as where we live, the state of our environment, genetics, our income

and education level, and our relationships with friends and family all have considerable impacts on health ..."

Designing for well-being and health includes a plethora of opportunities and a range of criteria. The strategy is that designs are good enough to meet the quantitative health measures but are also adaptable to and integrated with a broader set of principles to support well-being. There is a potential risk that, in an attempt to design the technically 'perfect' environment, we risk reducing the importance of the stimuli that encourage occupants to be active, aware and engaged. Designs should 'nudge' users in to positive behaviors, not by making them comfortable and controlling their environment excessively closely, but by providing a range of suitable stimuli for behavior change. An extreme example of this is the design for the Bioscleave House by Gins and Arakawa, intended to "strengthen life by challenging it ... to stimulate physiological and psychological renewal by creating living environments that would be intentionally uncomfortable". It achieves this by, amongst other things, changing floor-to-ceiling heights, distinct use of colour, uneven and sloping floor surfaces, and uncomfortable door sizes. This intentionally disorientating approach demonstrates an extreme approach, but a moderate and pragmatic orchestration of architecture to promote well-being is clearly viable.

One of the opportunities of architecture is that, through the design of form, space and materiality, it can order our relationships with each other and our environment by creating interactive settings for life. It can do this in such a way as to provide opportunities to improve our sense of well-being, enrich our lives, make our lives healthier and more pleasurable. For example, the shaft of sunlight in a recessed window seat that creates a moment of warmth and calm, combined with a glimpse of nature, soft and acoustically absorbent seat materials, and the tactile delight of the smooth grip to adjust a wooden shutter. Our well-being is intimately linked with such moments of delight. To an extent, such stimuli happen all the time, often without being recognized or designed, but when they are orchestrated throughout a building the effect is cumulative. A poor building has few such moments and leaves our lives impoverished,

whereas a successful piece of architecture is one where there is an accumulation of many moments of delight that support the five ways of well-being.

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