

Conclusion

The novelty of this work has been to study and measure how architectural design influences physical activity in offices. The aim has been to identify whether influencing population-wide levels of activity *through office tasks alone* may be possible. Monitoring evidence has shown that although a substantial part of the office day is spent seated at the desk (reported to be no less than a mean of 70% of the work-time), on average, physical activity during work-time may occur at greater levels than during leisure-time. An architectural vocabulary has been introduced to assign spaces with a value in promoting different purposes of activity. Activity purposes have been related to physical, job-related imperatives (e.g. going to the toilet, meeting the manager) or with more “voluntary” purposes (e.g. walking to colleagues’ desks or to the kitchen). The statistical analysis and KINESIS model have suggested that the probability of a “voluntary” trip to an office destination is a function of the effort (distance walked and stair use) required and spatial “reward” (window opening) related to the trip destination.

In exploring the overall complexity of the topic of “designing for movement”, this research has faced a number of challenges and has broken new ground by monitoring human physical activity in office buildings. Future research will aim to validate, extend and expand existing models; focus on a larger variety of environmental design layouts; design and test different KINESIS layouts and combinations, and assess different office management cultures and larger samples. A further question is whether the new workplace design for flexible working and incentive schemes, as currently promoted, can provide a solution to consuming less building energy and expending more human energy. A preliminary assumption, especially regarding the minimization of the use of lifts and the increase of natural lighting by larger windows, is that building efficiency, space -use effectiveness and public health can be achieved by design.

Glossary

Technical or quasi technical terms drawn from a variety of fields (including health-related, social science and applications of architectural theory) are presented here. Starred (*) words below have been introduced for the purposes of this research.

Architectural design Indoor environmental layout characteristics (e.g. open-plan or cellular, existence of stairs, window openings).

Attractors* These are office space configurations that have been shown to invite users' movement. In the cases of the sites under investigation, these were the kitchen, coffee and tea stations, toilets, print room, common areas and other offices in which users congregated over the day at work.

B.M.R. Basal metabolic rate: The minimum amount of energy required by the human body for lying in a state of physiological and mental rest.

B.M.I. Body mass index: A statistical method of comparing an individual's height and weight in order to identify potential weight-related problems such as obesity. The B.M.I. is given mathematically by the ratio of the individual's weight (kg) divided by the square of the individual's height (m).

Cellular office space An office layout composed of adjacent enclosed spaces.

Desk "Islands" Desks placed haphazardly or informally within the office space to enable quick and informal meeting.

D.I.T. Diet induced thermogenesis: Also called post-prandial thermogenesis (P.P. T.) or the thermic effect of food (T.E.F.). It accounts for about 10% of the total energy intake of a mixed western diet and it is the amount of energy used in digestion, absorption and transport of nutrients.

Dynamics of movement The variety of physical activity levels and intensity during time awake or a set research time-span.

Dynamics of space A system of dependent spatial attributes that can direct individuals' or groups' work-time physical activity.

Energy expenditure (E.E.) Humans oxidize (metabolize) carbohydrate, protein and fat to produce energy and maintain body functions (e.g. breathing and heartbeat). Energy expenditure can be measured in joules (J), kilojoules (kJ) or calories (cal) and kilocalories (kcal). As the nature of “work” is constantly changing, with the use of technology and the growing use of machines that replace human activity from the building site to the household, bathroom or kitchen, these activities become less time-consuming and less human energy-demanding.

G.I.S. Geographic Information Systems.

H.V.A.C. Heating, Ventilation and Air-Conditioning: This acronym is used in work related to indoor environmental comfort.

Home* This is an individual’s office workplace.

IT Information Technology.

Leisure-time Time spent away from the office worksite. This may include travel (e.g. to and from work), lunch (away from the office worksite), exercise, sleep and household activities (e.g. cleaning, gardening).

Link* Indoor office circulation routes and zones. These may be corridors, stairs, atrium stairs and elevators.

MET The Metabolic Equivalent of physical activity intensity, a term commonly used in health-related sciences to express metabolic rates.

Movement* The physical action of walking from e.g. an individual’s office desk to destination. It is defined as an activity within the topography of an office space.

Office hours Hours spent within office configurations performing tasks.

Open-plan space An office layout where all office spaces and functions co-exist in a single space that is unobstructed by designed partitions such as walls.

Physical activity (P.A.) *“Physical activity is any bodily movement produced by skeletal muscles that results in energy expenditure...”*. (see: U.S. Department of Health and Human Services 1997)

Power The rate at which a human body expends energy at a given time. This in the metric S.I. system is expressed in Watts , that is Joules per second.

R.M.R. Resting metabolic rate: The minimum metabolic rate required by the body in order to support its basic physiological functions, including breathing, blood circulation and all the numerous biochemical reactions needed to sustain life. The R.M.R. generally accounts for 60–75% of human total daily calorie expenditure.

Rewards* Architectural design rewards for occupant movement are mostly visual or social and provide some interest, encouragement and satisfaction to the office users who perform a task around or near them.

S.I. The international system of units which is abbreviated from the French *Système International d' Unités*.

Trip* This is an occupant's journey within the office site. This journey is assumed to always start from an initial office location (i.e. a desk) and end at another office location (i.e. the kitchen, another person's desk). We have assumed all trips within the worksite to be single, from location A to B, and not en route (multiple destination). For reasons of clarity and of eliminating noise from the research statistical analysis, it has been agreed that multiple-destination trips will be broken down into distinct trips starting from different initial locations. This more complex type of journey is expected to be analyzed in further research.

Voluntary trips* Trips that have an alternative of not being made; however, they are carried out. Levels of voluntariness may range between three categories ("highly voluntary", "voluntary" and less "voluntary"). Less "voluntary" trips mainly due to physical or job related purposes (e.g. going to toilet, meeting the office manager) are also defined in this work as "imperative".

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