

Healthy building environments for ageing adults

Helianthe S.M. Kort PhD^{a,b,*}

^aResearch Center Health and Sustainability, Utrecht University of Applied Sciences, Utrecht, the Netherlands; ^bDepartment of the Built Environment, Eindhoven University of Technology, Eindhoven, the Netherlands; *Corresponding author: helianthe.kort@hu.nl

H.S.M. Kort. Healthy building environments for ageing adults. Gerontechnology 2017;16(4):207-210; <https://doi.org/10.4017/gt.2017.16.4.001.00> A healthy building environment, when looking from a gerontechnology perspective, should facilitate ageing adults' functioning, self-esteem, and prosperity. Creating healthy environments is becoming more and more relevant in society. Older adults tend to stay more indoors when compared to younger populations; ageing adults need to work longer than before since the retirement age is increasing. In order to create healthy building environments both outdoor and indoor, environmental aspects need to be considered. Steps towards creating healthy building environments demand further research on the association between indoor environmental factors and ageing adults, how the indoor environment affects older people's health due to pathological ageing, and how the indoor environment affects older people's well-being.

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The international journal on the fundamental aspects of technology to serve the ageing society has older adults or, as one wishes, ageing adults as its target group. Topics addressed in this journal vary from technologies for health and self-esteem, housing and daily living, communication and governance, and work and leisure according to the gerontechnology matrix¹. This matrix provides researchers with a frame in which they can lay the focus of their research in seeking technology applications which benefit the ageing society. This special issue is organized by the Dutch-Flemish Chapter of the International Society for Gerontechnology (ISG), and has a focus on healthy building environments for ageing adults, a topic which has multidisciplinary aspects. How the environment affects health is well documented for the general population but less emphasis is given to ageing adults, despite it is well known that the world population is ageing and that ageing adults spend most of their time indoors due to minimal outdoors activities.

A healthy building environment can be considered an environment in which the health of an individual is not at risk or harmed and which supports the health and well-being of those living with a chronic disorder². ISG Grandmaster Annelies van Bronswijk discusses in the paper Healthy housing for active aging that housing is a preventer of chronic morbidities and an enabler of physical, mental and social health³. A healthy building environment when looking from a gerontechnology perspective should facilitate ageing adults' functioning, self-esteem and prosperity. Healthy building environments may comprise dwellings, offices, or utility buildings

such as nursing homes, hospital, and schools. In healthy building environments, both indoor and outdoor environmental aspects are addressed in order to respond appropriately to ageing adults' needs and wishes.

CREATING HEALTHY BUILDING ENVIRONMENTS: A THEORETICAL VIEW

Creating healthy building environments is becoming more and more relevant in society. Older adults tend to stay more indoors when compared to younger populations; ageing adults need to work longer than before since the retirement age is increasing; Society increasingly values sustainable environments which support the functionalities of buildings' users. Adding value to environments goes beyond sustainability for energy saving only but reaches out to sustainable life for quality and positive health. Positive health is another perspective of health which is described as the ability to adapt and to be in charge while facing the societal, physical, and emotional challenges in life⁴. Positive health includes areas almost similar to the participation domains in the gerontechnology matrix. Topics addressed in positive health are: body functions; mental well-being; giving meaning to life; quality of life; participation; and daily functioning⁵. However, these topics are defined from a health perspective only. The philosopher Epicurus (341 – 270 BC) addressed the value and meaning of the (built) environment for a meaningful healthy life⁶. One of the famous Dutch architects Gerit Rietveld had the same view. He designed the Rietveld-Schröder house for the widow Truus-Schröder and she made sure that her desires for living were included in the design of the house.

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The house was built in 1924 and it is the architectural highlight of the De Stijl art movement (*Figure 1*). It is the only building built entirely according to the architectural principles of De Stijl. The house is a living changing dwelling because of the use of the walls, doors, and windows as planar spatial elements along with the use of the colours red, blue and yellow in combination with white, grey, and black. In addition, the inside and outside are seamless connected⁷.

In this house Truus Schröder lived happily and independently till the age of 97 years. When Truus-Schröder was 90 years it became more difficult for her to work with the sliding panels. The house has no interior walls. Truus-Schröder though did not want to move to another home because the house was so dear to her so she stayed and aged-in-place. Currently in 2017 the Rietveld-Schröder house symbolizes the Utrecht region's game changing mind and the ambition for the citizen to live as long as possible healthily in an urban environment.

Currently most of the older adults age-in-place. Ageing-in-place refers to growing older in one's own house and community instead of living in residential care. A study by Wiles et.al. (2011) revealed that older people see ageing-in-place as "a sense of attachment or connection and feelings of security and familiarity in relation to both homes and communities"⁸. A relevant issue for older people when they age-in-place involves in health and security. In the Dutch project Technology@Home, three dwellings were built each having an emphasis on a special target group. This was because older adults are a diverse group and each of them may have widely different life experiences. These target groups were taken from a health perspective only. One dwelling was built for those people with a low care demand but for whom health and security are important. In the second and third dwelling designs, features are incorporated which take into account an increased need for more intense care, respectively from a demand for care for people

with COPD and low mobility up to a dwelling for people with dementia⁹. When designing dwellings for older adults to age-in-place, a good starting point is taken with a health perspective as defined by positive health. Design features should consider older people's limitations and restrictions in daily life resulting from the normal ageing process. These include impairments to hearing, vision, the neuromusculoskeletal system and cognition¹⁰, or specific chronic illnesses.

HEALTHY BUILDING ENVIRONMENTS: IN PRACTICE

In order to create healthy building environments outdoor and indoor environmental aspects need to be considered. Outdoor environmental aspects, such as neighbourhood walkability, access to facilities¹¹, the availability of green spaces which support social contacts among neighbours and strengthen communities for the ageing population¹², also contribute to aging-in-place. Next to outdoor and indoor climate aspects, social aspects comprising mental aspects are relevant. Social aspects seen from the perspective of the International Classification of Functioning and Disabilities (ICF) framework are amongst others the availability and quality of healthcare staff. An example of social aspects in relation to healthy environments was seen in the relevant role of staff. In the Netherlands, nursing homes' staff were unaware of the relevance of light conditions for older people while also light conditions in nursing homes were poor and below the current standard of 750 lux, thus resulting in low quality of visual comfort and visual functioning¹³.

Healthy building environments should also benefit older adults' wishes and needs which are beyond health. A healthy building environment should also support work and leisure activities or just activities for daily life. Therefore, it is also significant that older adults are informed and aware of the possibilities of smart technologies. For instance, a serious game which enables ageing-in-place that will help older people to meet their wishes to be social and physical active¹⁴.

Currently, the primary focus in healthy building environments is on physical factors. Physical factors include indoor environmental aspects such as light, acoustics, heat, ventilation, and indoor air quality. These aspects influence all individuals but mostly older adults. Due to their biological ageing, they will adapt more slowly to change (stressed situation) in the environment. It is well known that older adults differ in thermal comfort perception from younger cohorts¹⁵ and that older people are more at risk of getting dry eyes symptoms¹⁶. Older people with dementia even respond differently to changes in the thermal climate when compared to healthy cohorts¹⁷. In addition, there is some evidence that poor bed-



Figure 1. Rietveld-Schröder house by Wouter Jansen

room indoor quality, measured by CO₂ levels has a negative influence on sleep quality and thus on next day behavioural and psychological symptoms (BPSD) of people with dementia living at home¹⁸. Sleep quality is related to: health status; emotional states; bedding conditions; and indoor environment (air quality and ambient temperature)¹⁹. For younger adults' sleep quality is related to next-day performance²⁰ and deeper sleep²¹. Such an association is also expected for ageing adults but probably with a less positive influence on their sleep. Breathlessness in older adults is significantly associated with elevated concentrations of toluene and o-xylene when compared to the general population²². A multicentre study from Europe also showed that the respiratory condition of older adults living in nursing homes is affected by the indoor air quality²³. Although little is known of the relationship between the built environment and the health of older adults, in this issue, some papers describe how to assess the indoor environment and how to change the environment for the benefit of ageing adults.

In the Netherlands, hospitals and long-term care facilities are in transition due to changes in regulations such as the change from result-funding towards performance-funding which forces health-care organizations to improve the provision of care. Some organizations have implemented this in their mission to change their real-estate into healing environments or enriched environments for older people. The latter applies to long-term care facilities such as nursing homes where older people reside whose health will further deteriorate. The thought behind this is that a healthy in-

door environment will benefit staff and residents or patients. In the Netherlands, the legal building performance requirements for care facilities are minimal with regards to the functionalities of a building. Building performance requirements including health and user's functionalities are usually not applied due to budget limitations. In addition, little evidence is available of the positive effects of the indoor environment on staff and patients²⁴.

CONCLUSION: CREATING HEALTHY ENVIRONMENTS

Steps towards creating healthy building environments demand further research on the association between indoor environmental factors and ageing adults; how the indoor environment affects older people's health due to pathological ageing and how the indoor environment affects older people's well-being. Furthermore, more evidence is needed of the pathways on how the environment prevents older adults from developing a non-communicable disease and the pathways which support ageing adults with frail health. This is because it is known that the susceptibility to the indoor environment can be enhanced by other factors, for instance, lack of mobility or an imbalanced diet. In the end, the interventions in order to create a healthy building environment should not only take into account general safety, security regulations and energy savings, as they currently do, but should also consider the health demands of users. Most importantly, the voice of the users should have a role in the decision for creating a healthy environment.

References

1. Bouma H, Fozard JL, van Bronswijk JEMH. Gerontechnology as a field of endeavour. *Gerontechnology* 2009;8(2):68-75; <https://doi.org/0.4017/gt.2009.08.02.004.00>
2. Kort HSM. Building for care and health (In Dutch) *Bouwen voor zorg en gezondheid*, Inaugural speech October 12, 2012 Eindhoven University of Technology Eindhoven
3. van Bronswijk JEMH. Healthy housing for active aging. *Gerontechnology* 2015;14 (4):187-191; <https://doi.org/10.4017/gt.2016.14.4.001.00>
4. Huber M, Knottnerus JA, Green L, van der Horst H, Jadad AR, Kromhout D, Leonard B, Lorig K, Loureiro MI, van der Meer JW, Schnabel P, Smith R, van Weel C, Smid H.. How should we define health?. *BMJ (Clinical research ed.)* 2011;343:d4163; <https://doi.org/10.1136/bmj.d4163>
5. Huber MAS. Towards a new, dynamic concept of Health Its operationalisation and use in public health and healthcare, and in evaluating health effects of food PhD Thesis Maastricht University, Maastricht
6. Epicurus The essential Epicurus : letters, principal doctrines, Vatican sayings, and fragments. Eugene O'Connor, trans. Buffalo, N.Y.: Prometheus Books. ISBN 0-87975-810-4.
7. Emmons P, Mindrup M. Material Models and Immaterial Paradigms in the Rietveld Schröder House. *Journal Of Architectural Education* 2008;62(2): 44-52; <https://doi.org/0.1111/j.1531-314X.2008.00239.x>
8. Wiles J, Leibing A, Guberman N, Reeve J, Allen R. The meaning of "ageing in place" to older people. *Gerontology* 2011;52:357-366.
9. Kort HSM, Hoof van J. Smart technology at home: a multidisciplinary challenge. *Gerontechnology* 2008;7(2):144-144; <https://doi.org/10.4017/gt.2008.07.02.081.00>
10. Mann WC, 2003 Assistive Technology. In: N. Charness and KW. Schaie, eds. *Impact of technology on successful aging*, pp. 177-187, Springer, New York, USA, 2003.
11. Berg van P. *Travel Behaviour and Society* 2016;5:48-55
12. Kemperman A, Timmermans H. Green spaces in the direct living environment and social contacts of the aging population. *Landscape Urban Plan* 2014;129:44-54.

13. Sinoo M. PhD Thesis Light Conditions in Nursing Homes: Visual Comfort and Visual Functioning of Residents, 2016 Eindhoven University of Technology, Eindhoven
14. Dijkstra A, Kazimier-van der Zwaag H, Kooistra W, Swildens G. Exergaming to support mobility for older adults. *Gerontechnology* 2016;15(0):107-107; <https://doi.org/10.4017/gt.2016.15.s.579.00>
15. Schellen L. PhD Thesis Beyond uniform thermal comfort. On effects of non-uniformity and individual physiology, 2012 Eindhoven University of Technology, Eindhoven
16. Sharma A, Hindman HB. Aging: A Predisposition to Dry Eyes. *Journal of Ophthalmology* 2014; Article ID 781683: 8 pages; <https://doi.org/10.1155/2014/781683>
17. van Hoof J, Kort HSM, Hensen JLM, Duijnste MSH, Rutten PGS. Thermal comfort and integrated building design for older people with dementia. *Building and Environment* 2010;45(2):358-370; <https://doi.org/10.1016/j.buildenv.2009.06.013>
18. Cremers B. Effect of CO₂ on restlessness of an Alzheimer patient. *REHVA Journal* 2015;5: 41-44
19. Zhang B, Wing YK. Sex differences in insomnia: A meta-analysis. *SLEEP* 2006;29(1):85-93
20. Strøm-Tejsen P, Wargocki P, Wyon DP, Zukowska-Tejsen D. The effect of CO₂ controlled bedroom ventilation on sleep and next-day performance. In: 13th SCANVAC International Conference on Air Distribution in Rooms 2014.
21. Mishra AK, Ruitenbeek AM, Loomans MGLC, Kort HSM. Window/door opening mediated bedroom ventilation and its impact on sleep quality of healthy, young adults. *Indoor Air* 2017;1:13; <https://doi.org/10.1111/ina.12435>
22. Bentayeb M, Billionnet C, Baiz N, Derbez M, Kirchner S, Annesi-Maesano I. Higher prevalence of breathlessness in elderly exposed to indoor aldehydes and VOCs in a representative sample of French dwellings. *Respiratory Medicine* 2013;107:1598–1607; <https://doi.org/10.1016/j.rmed.2013.07.015>
23. Bentayeb M, Norback D, Bednarek M, Bernard A, Cai G, Cerrai S, Eleftheriou KK, Gratziau C, Holst GJ, Lavaud F, Nasiowski J, Sestini P, Sarno G, Sigsgaard T, Wieslander G, Zielinski J, Viegi G, Annesi-Maesano I. Indoor air quality, ventilation and respiratory health in elderly residents living in nursing homes in Europe. *European Respiratory Journal* 2015;45(5):1228–1238; <https://doi.org/10.1183/09031936.00082414>
24. Huisman ERCM, Morales E, van Hoof J, Kort HSM. Healing environment: A review of the impact of physical environmental factors on users., *Building and Environment* 2012;58(0):70-80; <https://doi.org/10.1016/j.buildenv.2012.06.016>