

sheldon



smart habitat  
for the elderly

First shield-on conference meeting  
**Proceedings Book**

Riga 10th October 2018

 **cost**  
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IN SCIENCE & TECHNOLOGY



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**Cost action CA16226**

Indoor living space improvement: Smart Habitat for the Elderly

**Sheldon**

Furniture, Habitat, Active and Healthy Ageing, ICT, Healthcare

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## Preface

We are pleased to welcome you to the first international conference of COST Action CA16226: "Indoor living space improvement: Smart habitat for the elderly" (SHELDON). This conference, held in Riga, Latvia on October 10th, 2018, follows a year of joint work, short term scientific missions, and networking. It is the first SHELDON organised event where participants will share their work over the past with each other. Researchers and practitioners working in habitats and furniture, ICT tools, services, and devices, and health care for older adults will come together to discuss, to share, and to learn from one another. We hope the conference provides an opportunity to build new collaborations between the working groups, to extend both the fundamental and applied research work through multidisciplinary cooperation that ensures stakeholder needs are addressed. Through these activities, SHELDON will contribute to healthy, active, safe, and sustainable environments for older adults that allow them to live independently and with dignity.

The needs of an ageing population extend beyond the border of any country or region and are truly a global concern. Together, SHELDON participants will advance the state of the art to refine, innovate, and create new solutions that drive global change that increase the wellbeing of older adults, that support their caretakers, and that ease the socioeconomic concerns related to ageing.

The first conference of the SHELDON COST Action will allow us to strengthen our network, find joint interests, and further define the activities we will cooperate on over the coming years. We hope that all attendees take advantage of the degree of expertise present, engage, and challenge each other.

We are convinced our first conference will be a successful event that broadens our network, results in new collaborations, and builds lasting friendships within the SHELDON network.

On behalf of the core group,

Mike Burnard, Vice-Chair  
Francisco Melero, Chair

# Index

## Furniture & Habitat Industries

### Working Group 1 Proceedings

- 1/5 Bringing nature indoors: Design and development of indoor living spaces in harmony with nature for active and healthy ageing in urban environments | **6** |
- 2/5 Measurement of elderly people preference and acceptance of natural materials with wearable sensors | **10** |
- 3/5 Modified wood and psychological well-being | **14** |
- 4/5 Positive role of Technical solutions in Social inclusion of the elderly | **17** |
- 5/5 The unit layout as a system and its effect on the QOL and behavior of the residents in long term care nursing homes creating a new tool for measuring, evaluating and comparing different building layouts | **19** |

## Healthcare.

### Working Group 3 Proceedings

- 1/8 11 principles of spatial design for well-being of older adults | **69** |
- 2/8 Addressing use and technology in dignified and positive aging; Its Applicability in Living Lab Social at real environment | **73** |
- 3/8 Are emissions in residential environments still a toxicological issue? | **76** |
- 4/8 Development of an advanced air quality assessment system in residential and office environments for people with respiratory diseases | **80** |
- 5/8 Influence of lifestyle and environmental risk factors on elderly frailty | **83** |
- 6/8 Key Points From Scoping Review: Technological Solutions for Older People | **86** |
- 7/8 Mental health monitoring of elderly people during daily life activities | **89** |
- 8/8 Sustainable environments for elderly people | **92** |

## ICT developments.

### Working Group 2 Proceedings

- 1/14 Ageing in digital environment | **24** |
- 2/14 AmlCare: a low-cost AAL solution and its deployment | **28** |
- 3/14 Design of software for active ageing | **32** |
- 4/14 Facial expression recognition towards smart living environment for people with physical disabilities | **34** |
- 5/14 Facial expression recognition: pair matching approach | **37** |
- 6/14 Feature and sensor selection for AAL | **42** |
- 7/14 Higher education programme on building information modelling towards the development of smart environments for Seniors | **44** |
- 8/14 Privacy and data security concerns toward home sensor technologies among the oldest old | **47** |
- 9/14 Privacy-aware and acceptable lifelogging services for older and frail people: the PAAL project | **49** |
- 10/14 Smart Ageing: Are we succeeding? | **52** |
- 11/14 Smart your home. How to make seniors' homes smarter | **54** |
- 12/14 Survey of IoT tools and deployments for Healthcare and AAL scenario | **57** |
- 13/14 Unconstrained face recognition under mismatched conditions | **60** |
- 14/14 Use of sensors for the monitoring of the physical training of elderly people | **65** |

# Working Group 1 Proceedings

## Furniture & Habitat Industries

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# Bringing nature indoors: Design and development of indoor living spaces in harmony with nature for active and healthy ageing in urban environments

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**dwelling of elderly, well-being, architecture  
design, interior design, urban areas**

The focus of this research is improving well-being and happiness of the elderly in terms of design and development of their indoor living spaces in harmony with nature. Multiple scientific studies have pointed out on the benefits and importance of nature for people, and especially for children and older populations. These benefits (increased participation in physical activities, improved mental health and cognitive function and an increase in social interaction) found through access to nature are key ingredients to well-being during ageing. As our population ages rapidly, and at the same time, the majority of people live in cities since urbanization is continuing worldwide, it is important to provide and foster re-connection with nature for the senior members of our communities. Today's cities suffer from many health and environmental problems. In recent years the growing awareness of sustainability and climate change issues make it even more apparent that bringing nature into our homes is essential.

Bringing nature indoors causes people to feel happier, healthier, calmer, and at the same time more energetic and optimistic about their lives. Natural environments also help to improve sleeping patterns, reduce pain, speed up recovery and even increase longevity. Nature, with all its elements, has a great power on a human body. It can make that we feel in harmony with the surrounding environment, and above all welcomed into a space. The biophilia hypothesis suggests that there is an innate connection between humans and nature and that people tend to show a positive response when they experience a connection with nature. It states that since humans originated from savannah-like environments they have "the urge to affiliate with other forms of life". When connected with nature and natural systems, humans can feel more emotionally content, and this has the potential to increase their life span.

How can we design an extension of nature in indoor living spaces for elderly? There are many inspiring ways to bring nature into homes: nature-based solutions, using of natural materials; plants– live walls, vertical walls etc.; natural elements; outdoor colours; views & light; etc. Design of spatial relations between outdoor and indoor spaces is also very important for the quality of indoor space. Even visual perception of nature, looking out a window into a garden or forest or viewing pictures of nature, can contribute to mental benefits that are especially significant for older inhabitants. All the above mentioned, called Biophilic design, is the design of spaces in a manner that promotes and encourages the interaction of humans with nature and natural systems.

This research deals with different design strategies, principles, scales, concepts and patterns of biophilic design for elderly people, as well as their different benefits for health and well-being, with the aim of improving the design of dwelling environments in urban areas. The research also stimulates further discussions about the question of how bringing nature indoor

through design (of interior/ architectural spaces, furniture) can improve the well-being of elderly, and how these can enable them to undertake activities that contribute to their well-being. It means creating a sensitive and responsive design that highlights a) visual connection to nature, b) palpability and soundness of the nature and c) nurturing a sense of place, a community in which the role of aesthetics is crucial for behavioural change.

## References

- Berto, R. 2007. *Assessing the Restorative Value of the Environment: A Study on the Elderly in Comparison with Young Adults and Adolescents*. *International Journal of Psychology*, 42 (5), 331-341.
- Browning, W., Ryan, C. and Clancy, J. 2014. *14 Patterns of biophilic design. Improving health & well-being in the built environment*. New York: Terrapin Bright Green
- Frumkin, H. 2008. *Nature Contact and Human Health: Building the Evidence Base*. In: S.F. Kellert, J.H. Heerwagen, & M.L. Mador (Eds.). *Biophilic Design (115-116)*. Hoboken, NJ: John Wiley & Sons.
- Hartig, T. 1993. *Nature Experience in Transactional Perspective*. *Landscape and Urban Planning*, 25, 17-36.
- Heerwagen, J.H. & Hase B. 2001. *Building Biophilia: Connecting People to Nature in Building Design*. US Green Building Council. Posted March 8, 2001. [🔗](#) Web. 19 July 2018.
- Heerwagen, J.H. 2006. *Investing In People: The Social Benefits of Sustainable Design*. *Rethinking Sustainable Construction*. Sarasota, FL. September 19-22, 2006.
- Hosey, L. 2012. *The Shape of Green: Aesthetics, Ecology, and Design*. Washington, DC: Island Press.
- Joye, Y. (2007). *Architectural Lessons From Environmental Psychology: The Case of Biophilic Architecture*. *Review of General Psychology*, 11 (4), 305-328.
- Kellert, S. R., Wilson, E. O. 2013. *The biophilia hypothesis*. Washington, DC: Island Press.
- Ryan, C.O., W.D. Browning, J.O. Clancy, S.L. Andrews, & N.B. Kallianpurkar. 2014. *Biophilic Design Patterns: Emerging Nature-Based Parameters for Health and Well-Being in the Built Environment*. *Archnet International Journal of Architectural Research*, 8 (2), 62-76.
- Skedung, L., Rawadi, C. El., Arvidsson, M., Farcet, C., Luengo, G. S., Breton, L. & Rutland, M. W. 2018. *Mechanisms of tactile sensory deterioration amongst the elderly*. *Scientific Reports Volume 8, Article number: 5303*
- Sternberg, E.M. 2009. *Healing Spaces*. Cambridge: Bleknap Harvard University Press
- Van den Berg, A.E., Hartig, T. & Staats, H. 2007. *Preference for Nature in Urbanized Societies: Stress, Restoration, and the Pursuit of Sustainability*. *Journal of Social Issues*, 63 (1), 79-96.



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