

DEVECI, G. 2019. *Hope Co-Housing: approach and innovation*. [Design]

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DEVECI, G.

2019

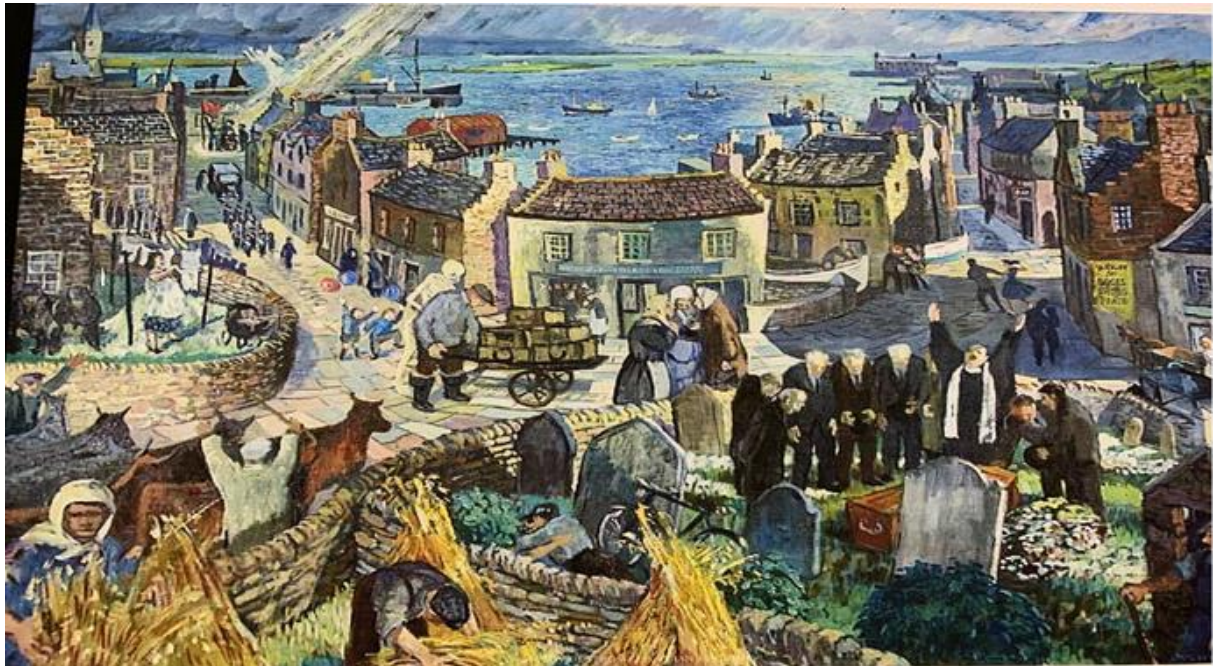
Hope Co-Housing: approach and innovation

The country is facing an aging population as people live longer. 10 million people in the UK are currently over 65, with a 5.5 million increase projected over the next 20 years. 3 million people are aged over 80 and that is expected to double by 2030. This puts additional strains on health and social services, with both a smaller proportion of working population available to support services and with the older population having more complex medical needs. The 'Hope Co-Housing' project is a new typology of housing that demonstrates a collaborative approach to age by combining the principles of salutogenic housing design, wellbeing and healthcare principles, and technology to support active ageing. The innovative homes will be co-designed with input from design, computing, health and care professionals, with the aim of creating a new typology of senior citizen housing in which people aspire to live and support each other, and which help to eliminate social isolation and fuel poverty. The proposal will be exploring how senior housing can be designed collaboratively to support health, wellbeing, activity and community engagement as people age. It will be multi-disciplinary, with anticipated expertise required from colleagues from several schools across the Robert Gordon University RGU and Orkney Island Council (OIC).

Material in this portfolio is currently taken from a single source:

1. A research report (pages 3-16)
 - DEVECI, G. 2019. *Approach and Innovation*.

Further sources may be added to this portfolio at a later date, as the project progresses.



APPROACH AND INNOVATION

Our vision is to establish the first co-housing community in Orkney and to do so as soon as possible. Our senior co-housing community will allow us to age actively, encouraging mental and physical well-being. The design will be eco-aware with an emphasis on sharing resources and limiting energy consumption. Our aim is to promote neighbourliness and address isolation. This in turn will reduce our demands on health and social care services. The five self-contained houses will connect to a communal area where we will have facilities for creative and recreational activities that the wider community will be invited to share. There will be a space to create a shared garden and even keep hens.....

Cath & Jenny - extract from Hope Co-Housing members

2019



HOPE CO-HOUSING
Community interest
Company



Communal space

Approach and Innovation

The 'Hope Co-Housing' project is a new typology of housing which demonstrates a collaborative approach to age by combining the principles of Salutogenic housing design, wellbeing and healthcare principles, and technology to support active ageing. The Innovative homes will be co-designed with input from design, computing, health and care professionals with the aim of creating a new typology of senior citizen housing in which people aspire to live, support and eliminate social isolation and fuel poverty. The proposal will be exploring how senior housing can be designed collaboratively to support health, wellbeing, activity and community engagement as people age. It will be multi-disciplinary, with anticipated expertise required from colleagues from several schools across the Robert Gordon University RGU and Orkney Island Council (OIC).

One of the key priorities for the proposed design is to encourage and support people in Orkney to “age positively” – to maintain a healthy lifestyle and to remain active and independent in later life. Not only will this improve individual lives, it will prevent increasing demand for support services in future years. The housing design will;

- enable residents to remain in their homes for longer
- reduce hospital admissions and enable early discharge
- provide a solution for people not wanting to enter a care home
- predict health related events and enable mitigation to enhance wellness

Background and Motivation

The country is facing an aging population, as people live longer. 10 million people in the UK are currently over 65 with a 5.5 million increase projected over the next 20 years. 3 million people are aged over 80 and that is expected to double by 2030 [2]. This puts additional strains on health and social services with both a smaller proportion of working population available to support services, and with the older population having more complex medical needs. With modern lifestyles, carers from within the family are also less available, as more people are tending to live alone and families live further apart with increased levels of relocation for work. In this changing scenario it is important that we help people with medical or social needs to live independently for longer and so reduce their reliance on more expensive health care solutions.

Currently, around 80,000 people in Scotland are receiving some level of care at home.

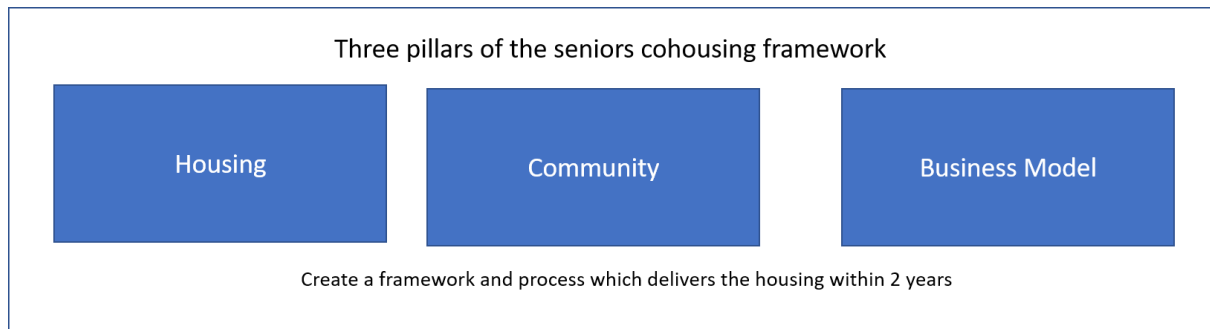
Orkney's demographic make-up is aging faster than the rest of Scotland. 2016 based National Records of Scotland (NRS) figures show that in 2019 24% of Orkney's population is 60 or over, with around 17% of Orkney's population being 70 or over. By 2030 the percentage of the population that is 60 and over is estimated to be 30%, with 21% being 70 or over. By 2040 figures increase further to 33% being 60 or over and 26% being 70 and over. In pure numbers the increase from 2019 to 2040 is from 6,851 over 60s to 8,337 and from 3,800 over 70s to 5,587. This increase will obviously require a new approach to older persons' housing and Co-housing will be a key part of this.

The Hope co-housing project will provide an alternative housing type that will help address the housing needs of Orkney's increasing older community. St Margaret's Hope has some Extra Care housing provision, but there are no options for older people who do not have care needs that require extra care housing, but who are looking for community, companionship and support. Hope Cohousing will provide that community and support and will help its residents actively age and remain in their homes for as long as possible without the need for formal care. If and when more formal care is needed, the properties at Hope Cohousing will be designed in such a way that residents can receive care without needing to leave home, if at all possible. This will aid the Local Authority and NHS Orkney by reducing the need for residents of Hope Cohousing to receive formal care at an earlier stage.

The cost of care to the NHS is becoming unaffordable, and is set to rise. Consequently, it is proposed to develop a technology-enabled 'Integra House' that will:

- enable residents to remain in their homes for longer
- reduce hospital admissions and enable early discharge
- provide a solution for people not wanting to enter a care home
- predict health related events and enable mitigation to enhance wellness

Project Framework



- Design an affordable housing development which is fully costed and can easily be replicated across rural areas
 - Create communal areas which promote social interaction and activity
 - Create a seniors smart house, which uses technology to support residents in their every day lives
 - Develop the houses as low cost to run - with the potential aim of heating costs to be under the national winter annual allowance of £300
- Develop a framework to establish cohousing projects within rural communities
 - Manage and run the framework and processes within communities for the communities
 - Support the development from initiation to completion
- Prove the benefits case for cohousing
 - Provide the business case and financials including funding mix of grants and loans
 - Work with government and local authorities to establish senior cohousing



Figure 1: Proposed site plan showing the access from Taftingus Place (to the left), communal and private garden areas, and arrangement of individual houses and social corridor

Design

The following design principles are based on the “Salutogenesis approach” which focuses on creating coherent living environments, whilst strengthening socio-ecological health for individuals, groups and communities:

- Ensure safety
- Encourage independence
- A familiar design in order to assist emotional security
- Offer sensory and mental stimulation
- Protect privacy
- Enable social interaction

Two basic typologies of houses were considered: the first a ‘haptic’ arrangement in which individual houses were rotated and orientated to create a collective central space; the second a terrace (or pair of smaller terraces) with a linear communal space to one side. The selection of the terrace typology was largely determined by a combination of site conditions and energy efficiency: the sloping site demanded a long, thin row of houses to reduce the amount of excavation (and associated cost), and a single building containing all houses has significantly less external wall area – and thus less heat loss – than a series of individual houses.

The proposed development site is currently zoned by OIC for housing. Its layout and design differ slightly from the indicative proposals included in the Local Development Plan.

Layout

The resulting single-storey layout consists of the six units connected by an enclosed 'social corridor' along its west side. The social corridor performs a variety of functions, and is an intrinsic element in the success of the project. As well as providing shelter on the exposed, western side of the building, the corridor offers a protected, *semi-private* garden space with a low wall before the front door to each house. It is highly-glazed, allowing lots of daylight and sunlight into both this space and the 'front' rooms of each of the houses, as well as long views north-westwards towards the ferry pier. Although uninsulated, the social corridor creates a *buffer space*, pre-warming fresh air entering each of the houses and reducing heat demand in the houses by 20%.

Each of the five dwellings has an identical layout consisting of two bedrooms, a bathroom, kitchen, sitting room and dining room. They are around 80sq.m in size, which is 20-25% bigger than a typical modern two-bedroom house in the area. The dwellings' predominant axis runs roughly east-west and they are arranged with 'day rooms' (kitchen, sitting room and dining room) to the south. South-facing skylights in these rooms provide sunshine, solar heat and ventilation. The houses have a vaulted roof over the day rooms, creating a much greater feeling of space and sense of airiness.

Taking inspiration from another RGU project, 'Fit Homes' – designed in conjunction with Carbon Dynamic – one of the bedrooms has a movable partition. This allows it to be made bigger in the event that the resident is confined to bed for a prolonged period and this becomes their principal room. The kitchen and bathroom are positioned centrally so all other rooms have windows looking out onto gardens to the east or the social corridor to the west.

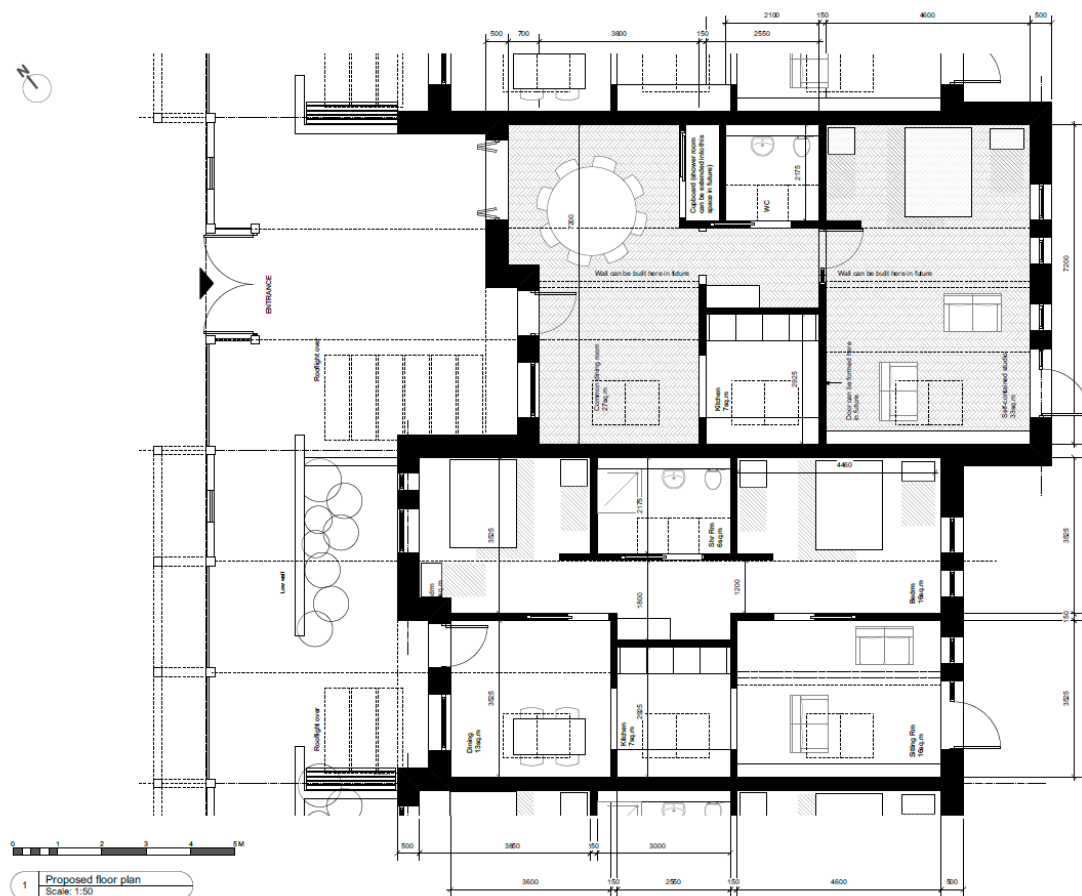


Figure 2: Proposed Plans, Section, and Site Section

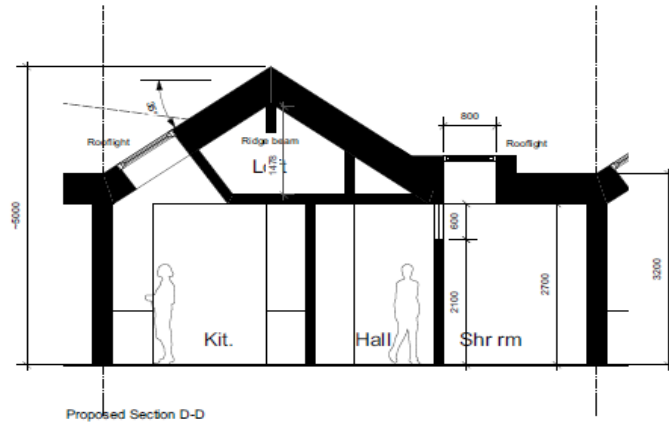


Figure 3: Proposed Section

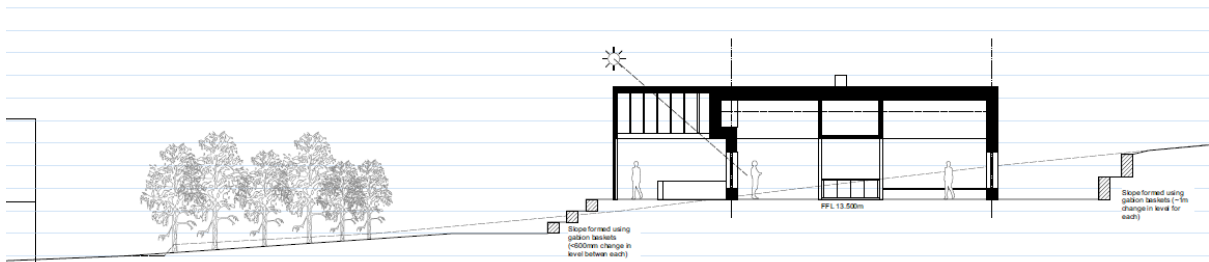


Figure 4: Site Section



Figure 5: Image from the west showing access to the site



Figure 6: Proposed communal room ; Figure 7: Proposed Bedroom (with moveable partition)



Figure 8: View of the social corridor showing the entrance to one of the houses. Figure 9: Image is a View looking through the sitting room of one of the houses, towards the private garden

Accessibility

It has been a key consideration in the development of the design. The whole project is single storey and doors and windows have been designed for wheelchair users.

Private external gardens are provided to the east side of each of the houses. A communal garden is positioned to the west side of the building, and surrounds the small amount of parking that is provided. The proposed layout intentionally minimises roads and parking area as part of the co-housing ethos, with a plan for residents to share a limited number of electric cars.

User participation in the design process and community consultation



community consultation

Construction

Six different construction methods were considered by the design team, including:

1. Prefabricated strawbale panels ('Ecococon');
2. Hollowcore clayblock and rigid woodfibre insulation;
3. Prefabricated, pre-insulated timber frame;
4. Insulated 'trussed' timber frame, insulation post-erection;
5. Cross laminated timber (CLT) and rigid woodfibre insulation;

These were chosen primarily based on their inherent non-toxicity and suitability for very high levels of energy efficiency. They were assessed across a variety of criteria including resistance to Orkney climate, degree of prefabrication and likely speed of construction, fire risk, use elsewhere in Scotland, and likely acceptability to mortgage lenders.

Environmental impact

The proposed houses will be extremely energy efficient, with heat loss around 15% of a typical new house built to meet the Building Regulations.

Initial energy assessments have been undertaken on the project: which has identified that heating for the houses will cost between £220 - £240 per year per house.

Selection of an appropriate system to provide heating and hot water formed a key part of the study. The compact nature and close proximity of the houses to one another suggested that there may be benefit in utilising a single, communal 'district heating' system rather than six individual heating and hot water systems. A district heating system is composed of a single 'boiler (where heat and hot water are generated) from which a circuit of insulated distribution pipes conveys heated water to individual houses, where it is metered before being used for heating or hot water.

Due to a lack of gas infrastructure on Orkney, heating and hot water in homes tends to be generated by electricity. Heat pumps are an increasingly popular means of using electricity to generate heating and hot water. To explore further the potential for a heat pump district heating system, were commissioned.



Figure 9: Typical Holz100 panels being put together to form a house. Figure 10: Typical Ecococon panels being put together to form a house

The Innovation

To deliver a pioneering 'co-living' community for 6 homes in St Margaret Hope, Orkney where facilities such as kitchen, utility spaces, visitor facility, social corridors and landscaped garden areas are shared between the residents. St Margaret's Hope Co- Housing project will include two rented properties and four shared equity properties. With co- living still in it's infancy in the UK, RGU aims to contribute to research and practice relating to this new type of housing which could help to combat the social isolation many people feel in rural and remote areas through provision of a supportive and distinct community structure. Incorporation of technical and environmental innovations for future proofing are as follows:

- Apps and sensors - A range of sensors capturing data targeting specific activities and providing alerts to enable families and or agencies to intervene with preventative measures before incidents occur.
- Artificial Intelligence - Interactive dialogue systems that are integrated within homes and contextualise conversation based on what is being sensed.
- Low-energy - energy supply, renewable heating and ventilation systems, construction processes, and healthier materials to provide an improved indoor quality for well being
- Buildability- modern methods of construction (MMC)

Technical Innovation

The technical research in this project is innovate in several ways:

- **Developing algorithms that employing video to assess gait and other characteristics in an uncontrolled shared space:** there are existing camera solutions that measure gait characteristic, however there are performed in controlled environments and we are not aware of any integrated health care solutions that are operational in an uncontrolled space. AI and ML are central to the project; new and improved Deep learning algorithms will be investigated to improve gait analysis, while CBR will provide a reasoning layer that is aware of context.
- **Delivering a system as an automated framework:** the analysis algorithms will be embedded in a system that automatically undertakes the data analysis in near real time, identifies the resident, and compares current movement characteristics with the resident's historic data, and if required recommends a possible need for intervention;
- **Application in a real-world setting:** the system will be deployed and evaluated in a in a real-world setting, rather than a lab environment, and is likely to raise additional unforeseen challenges; and
- **Integration with health and social care practitioners to follow-up and implement proposed interventions at an early stage:** supports prevention is better than treatment. Seniors may not notice a deterioration in their movement or health and even if they do may put off visiting health care professionals for many reasons; independent monitoring by sensors can reduce the time lag between deterioration being evident and intervention taking place.

Stage 1 will deliver (10):

- A review of the state-of-the-art in employing sensors for in-home health monitoring to establish strength and weaknesses of alternative approaches;
- A requirements gathering workshop employing a co-design approach that includes both potential residents + health care professionals
 - establish what to measure and by which sensors,
 - consider privacy issues + system opt in / out requirements;
- Initial experiments to gather data and explore gate analysis algorithms; and
- Prepare a fully developed design and implementation proposal for stage 2 of the project to deliver a functional application at TRL 7.

Impact

The longer-term project impact outcomes are as follows:

- Economic Impact – cost reduction to both the NHS as well as Local Authorities through the provision of cohousing
- Wellbeing – A positive increase in wellbeing for seniors living in cohousing. This includes increased physical activity and social interaction against peers
- Business Model – A proven business model for Cohousing Developments
- Roll out of similar Cohousing schemes – Roll out of two further schemes within Orkney and a pipeline of further Cohousing opportunities, actively managed through Hope Cohousing

Multi-disciplinary research packages.

Co-Housing Design and delivery Professor Gokay Deveci (lead)

School of Architecture & Build Environment

School of Health Sciences Contribution - (Professor Kay Cooper),

Contribution; Developing smart systems that can inform health & social care professionals at appropriate time points in order for early intervention to maintain health/prevent decline.

School of Nursing and Midwifery (Professor Catriona Kennedy)

Contribution: Participatory approaches and the collection of qualitative data.

Dr Stewart Massie School of computing

Digital Assistive Technology for Active Ageing

Supporting active ageing. To design and implement an Intelligent Digital Caregiver. Interactive dialogue systems that are integrated within care homes and contextualise conversation based on what is being sensed

Space, Wellbeing and Self and Community and association (Dr Chris Yuill)

Provide insights from both fields to help tease out what are termed the 'lived experiences' of peoples' lives, how they relate to their surroundings and how they relate to other people living in the same space. Emphasise how these social and spatial aspects influence and shape health and wellbeing.

Multi-Disciplinary Research Team and themes

- Research theme 1 – Artificial Intelligence (AI) and Monitoring
- Research theme 2 - Physical activity levels and both wellbeing and quality of life
- Research theme 3 - Exploration of the experiences of residents of St Margaret's Hope around ageing well and their overall quality of life.
- Research theme 4 - The sociological element Social interaction, community and well being
- Research theme 5 - Salutonegic Housing Design for the ageing, Innovation, Environmental impact, and health & well being

Co-Housing Design and delivery, Professor Gokay Devenci (lead) School of Architecture & Build Environment

Participatory approaches and the collection of qualitative data- Prof Catriona Kennedy, School of Nursing and Midwifery

Transport / mobility package, Professor David Gray, School of Creative and Cultural Business

Space, wellbeing and self and Community and association, Dr Chris Yuill, School of Applied Social Studies

Digital Assistive Technology for Active Ageing Dr Stewart Massie School of Computing

Health and Social Care, Professor Kay Cooper (Physiotherapy): Older people, Self-management, Physical activity, Behaviour change School of Health Sciences

Research Packages

To support the longer-term benefits case of Cohousing, RGU have identified 5 key research themes:

Research Theme 1 – Salutonegic Housing Design for the Ageing, Innovation, Environmental Impact, and Health & Wellbeing – Professor Gokay Devenci

This research will be focussed on the delivery of collaborative design for the ageing.

Research Theme 2 – Artificial Intelligence (AI) and Monitoring – Dr. Stewart Massie

The use of sensors (fixed and wearables) to monitor wellbeing of cohousing residents. Through better monitoring, early changes in resident's activity and walking gait can be identified and interventions undertaken.

Research Theme 3 – Physical activity levels and both wellbeing and quality of life – Professor Kay Cooper

There is a known positive relationship between physical activity levels and both wellbeing and quality of life. It has been shown that it is possible to remain fit, active and to live well with long-term conditions well into later life, and that functional decline can be reversed or halted largely through engaging in physical activity and exercises.

Research Theme 4 – A longitudinal exploration of the experiences of participants around ageing well and their overall quality of life – Professor Catriona Kennedy

Research Theme 5 – The sociological element of Social Interaction, community and wellbeing – Dr Chris Yuill

How the community and social interaction emerge, or otherwise out of the materiality of the space, the landscape in which it sits and the activities and actions of residents. This in-depth research will provide a robust framework for a full evaluation of this housing mode, providing the longer-term benefits case of this approach. It will also greatly enhance further projects and inform on future designs of housing, even out with the current project's rural focus.

References

1. Forbes, Massie, Craw (2019) Fall prediction using behavioural modelling from sensor data in smart homes, *Artificial Intelligence Review*, 1-21”;
2. Sani, Wiratunga, Massie, Cooper (2016) SELFBACK: activity recognition for self-management of low back pain, *BCS conference in AI*;
3. Massie, Forbes, Craw, Fraser, Hamilton (2018) FITsense: Employing Multi-modal Sensors in Smart Homes to Predict Falls, *ICCBR*, 249-263



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'Alternative living arrangements as we grow older'.

Hope Co-Housing, St Margaret's Hope, Orkney.