A world class centre for research

Research for an ‘uncertain future’ is our big challenge for the next decade. The Sheffield School of Architecture is well placed to embrace the changing and unpredictable nature of research. Our applied research places increasing emphasis on partnerships, collaborations and working across disciplines.

Research in the School explores the social and political implications of architecture to help build better environments and better lives. We aim to shape the national research agenda and policy on the built environment, addressing professional and public needs.

We are consistently recognised for the difference our research makes to society, and the 2014 Research Excellence Framework (REF) confirmed our position as a world-class centre for architectural research.

We have recently been successful with two European Research Grants totalling €3.5M to conduct ground-breaking research addressing issues of soundscape design, and visualization of topological borders in the context of global migration.

We are committed to developing and diversifying our research environment to help make a positive impact on the built environment.

These groups bring together academic staff, researchers and postgraduate research students within shared interests. Our research strands weave across the groups:

– Building Local Resilience focuses on global strategies for developing local approaches to climate change
– Architectural Research Practice fosters Knowledge Exchange between industry, the civic sector and academia
– LiveWorks provides an experimental laboratory for participatory research and teaching

Some of the work of all these groups and strands is highlighted in the research activity showcased in this newsletter.

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People, Environments and Performance

Leading research into the design of spaces for people and how perceptions and performance are affected by changes in the environment.

Research to impact how we measure sound

Eighty million EU citizens are suffering from excessive environmental noise and billions of Euros are being spent on noise control, under the EU Directive on Environmental Noise. Unfortunately, the conventional approach, which aims for a reduction of sound level, does not deliver the required improvements in quality of life.

Soundscapes make up the components of the acoustic environment that can be perceived by people. They are hugely complex and measuring them as a basis for environmental design requires a step change to the discipline. A major new research project, funded by EU ERC and led by Professor Jian Kang, aims to achieve a ground-breaking development by establishing soundscape indices (SSID), a measurement which adequately reflects levels of human comfort.

The potential impact of this research will be reminiscent of that of the Decibel scale created by Bell Systems a century ago.

This project will underpin science for soundscaping in the field of built environment, with a wider goal of moving from noise control to soundscape creation.

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Transforming urban sound environments

A new generation of sound planners could transform cities making them more attractive and economically successful, according to a major European research project. Inadequate sound environments can dramatically reduce the usability of places such as parks, residential areas and meeting spaces. A lack of acoustic experts with the whole spectrum of knowledge and tools required makes it difficult for planners to develop a noise pollution strategy for an entire city.

Professor Jian Kang and researchers Francesco Aletta and Efstathios Margaritis have worked with partners in Europe to help integrate the sound environment into the planning process from the beginning. The Marie Curie funded SONORUS project has trained a new generation of urban sound planners, offering early career researchers the opportunity to develop their knowledge in urban sound planning. The project also brought together current research in the area to propose tools that can be applied to the planning process to help control, predict and design the sound environment.

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Funded by the EPSRC (2011-2015), the MERLIN project involved a collaboration between researchers of vision science and human factors of lighting. Alongside previous lighting research in the School, the study led to new national and international guidance on the colour of road lighting, which are used by local authorities. MERLIN 2, also funded by EPSRC (2015-2018), continues to gather evidence of the lighting conditions that enable pedestrians to walk safely, and to feel safe, so that a cost-benefit analysis of road lighting can be properly informed. Researchers are working with UK, US and international bodies for lighting standards to specify how much light is needed.

Dr Sofie Pelsmakers explains: “Many people are aware of ways to insulate their homes through cavity wall or roof insulation, however no easy solutions exist for insulating their floors. Up to 25% of our homes’ heat escapes through the floor so it’s crucial to look at new innovative and cheaper ways to tackle this problem.”

The new technologies are being installed and monitored in a small number of houses during the winter season. They will be assessed for their thermal performance and impact on occupant thermal comfort.

Tackling heat loss from timber ground floors

A study on heat loss from uninsulated timber floors aims to create new techniques to help save energy and money. It is estimated that 10 million homes across the UK have uninsulated timber floors. Traditional methods of insulation, adding materials like foam boards and wool, can be expensive and disruptive. Yet reducing ground floor heat loss would reduce energy use and associated carbon emissions, save money and make houses more thermally comfortable.

Researchers are working with Ufloor on an Innovate UK funded project to investigate and develop easy and cheap to install floor intervention measures to reduce ground floor heat loss.

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To begin, I had to find out which tasks are critical to a pedestrian, to ensure they can walk down the street safely at night. I used eye-tracking to record where pedestrians looked as they walked down a street, and identified the types of object and areas they looked at during critical times.

I used this information to design an experiment that examined the effect of different light conditions on our ability to see these important objects.

The eye-tracking experiment found that the most important task for pedestrians was looking for obstacles on the near footpath to avoid tripping. I therefore designed an obstacle detection experiment that examined what effect lighting had on our ability to see an obstacle. My results showed that increasing light levels above 2 lux had no added benefit in terms of improving detection of an obstacle. Given that current guidelines for pedestrian road lighting are based on inadequate evidence which could mean we are providing too much light.

Reducing light levels offers a rapid route to reduction in energy consumption and also decreases the amount of light reflected to the night sky and the impact of nocturnal lighting on wildlife and human health.

Jim Uttley: Investigating the influence of lighting in obstacle detection

Working with the School’s lighting researchers, my PhD aimed to provide more robust evidence on which to base guidelines on road lighting, specifically in relation to pedestrians.

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Overheating in UK buildings

The growing phenomenon of summertime overheating in domestic buildings is a summertime problem which can leave buildings uninhabitable and is recognised as a public health risk. Published research, using a 10-storey retrofitted tower block as a case study, found that while the flats were prone to overheating due to poor design, residents could take steps to avoid their homes becoming too hot. However, many did not because they were unaware of best practice – indicating they need better education to manage their own ventilation strategies.

As part of a 2-year Marie Curie funded project in collaboration with Wrocław University of Science and Technology and Lublin Institute of Technology in Poland, the study found occupants did not use ventilation systems already in place effectively and did not make best use of shading and opening windows. The study also found the most widespread practices were those that could be easily observed being carried out by other residents. The majority of inhabitants did not discover the best possible strategies when acting independently, which suggests that a collective learning process could have a significant role in improving the ways inhabitants tackle overheating.

Professor Fionn Stevenson said: “Design teams have managed to design in extra insulation to keep people warm, but they have not taken into account the fact that our cities are getting warmer and warmer each year. This requires extra consideration on shading options for windows and walls in the summer as well as ensuring excellent ventilation strategies that really get rid of heat accumulation. We need to help residents to be able to help themselves when it comes to ventilation, and not presume that ‘smart homes’ can do it by themselves.”

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Unlocking the potential for model-predictive control in building energy management

Current methods for controlling building systems are poor at anticipating the demand for heating, ventilating and cooling to meet occupants’ needs. They typically do not utilise weather forecasts and they are not updated in response to changes in occupancy, local site conditions, internal layout or following renovations. By failing to anticipate and adapt, buildings with current control systems use more energy and are less comfortable than they could be.

In response to this, a team of researchers from the School of Architecture and Departments of Civil and Electrical Engineering will develop and test a new Model Predictive Control Algorithm to control heating, ventilating and cooling systems in buildings.

Professor Darren Robinson is leading part of this EPSRC funded project which involves the preparation of synthetic data to train the new algorithm. This data is produced by a building performance simulation programme that is linked with team’s new platform for modelling human behaviour. This platform simulates when occupants are present as well as how they interact with the building. Combining the modelling of behaviour and building energy performance in this way enables us to test more complicated cases for the new algorithm to control. When the algorithm has been successfully trained and evaluated, it will be used, in partnership with ARUP, to control a real building.

Professor Darren Robinson explains: “This new algorithm has the potential to reduce the emission of greenhouse gases of complex non-domestic buildings, by as much as 30%, whilst also improving the comfort of their occupants. The use of synthetic data enables this algorithm to be tested on a large number and range of buildings without the time, cost and complexity of collecting real world data.”

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Hazard detection when driving in fog

While driving after dark we use lighting to offset the visual impairment. However, the presence of fog reduces visibility of distant objects, from about 1000 metres in clear conditions to 75m in thick fog. Fog also scatters light which means that too much light, and from the wrong location, can impair rather than improve the visibility of objects.

Researchers led by Professor Steve Fotios have collaborated with ARUP in a Highways England funded experiment to test the detection of potential hazards when driving in fog. A model of a 3 lane carriageway was constructed and participants were required to detect two hazards to see how the performance was affected by changes in lighting and fog.

The results suggested that when driving in thick fog, there is an advantage in road lighting of luminance 1.0 cd/m² compared with 0.1 cd/m². We see objects by the light they reflect and luminance tells us how much light is reflected. Typically, 0.1 cd/m² would be dim road lighting and 1.0 cd/m² would be relatively bright road lighting.

Drivers showed a quicker reaction time to the obstacles in thick fog with the lighting of higher S/P ratio. This suggests a benefit of using the higher S/P ratio which will appear whiter than the orange sodium lighting traditionally used in the UK.

The results will help Highways England develop their strategy for road lighting, for example, where, when and how much lighting to use.

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Exploring the role of design and architecture in purposeful societal and systemic change through research, advocacy, action and engagement.

Networks of resilience in urban communities

Neighbourhoods are becoming more resilient as a result of research led by Professor Doina Petrescu which proposes new models of urban regeneration. Communities in France and London have set up hubs which host and support a range of collective activities and this strategy is being adopted in other cities across Europe.

The R-Urban regeneration strategy was created by a team of international researchers and practitioners to provide a network of self-governed hubs. The hubs offer the land, buildings, tools and training to bring together individual initiatives.

The strategy and its implementation have received extensive international recognition from civic, professional sectors and policy makers. R-Urban is considered as a model for bottom up resilient regeneration which uses architecture as a driver to engage residents in participatory processes.

Researchers and architects worked with local partners in Colombes, France and Hackney Wick in London to design and build an infrastructure to support resilient practices. In Colombes the network of three hubs offers a micro-farm, recycling plant and cooperative eco-housing. The project involved 400 citizens in co-managing 5000 square metres of land, producing food, energy and housing, while actively reducing waste and water usage.

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Scaling resilience practices

Following the R-Urban initiative, researchers Corelia Baibarac and Professor Doina Petrescu have investigated ways of scaling community resilience practices and opportunities to do so through using digital technologies.

The EcoDA (Experimental Co-Design Approaches) project has developed digital tools that will enable local initiatives to become sustainable and allow new versions to generate elsewhere. The tools will connect initiatives across locations, allowing knowledge-sharing and the building of collective practices to generate larger scale urban transformations.

Researchers developed digital tools by working with potential users including practitioners and local communities from Paris, London and Bucharest. Sheffield Architecture Masters Students also took part in a Live Project to support in the development of a prototype. The prototypes include tools for the self-management of community resilience hubs and support for communities to resource urban commons initiatives. The digital tools have been brought together into one platform, which will be opened up to further development by users.

Dr Corelia Baibarac explains “Working on this project has allowed us to understand the diversity of challenges faced by those engaged in resilience projects in different cities that share similar needs. It has confirmed the importance of involving potential users in the design of tools that are intended to serve their needs and enabling them to articulate these needs.”

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The (in)visibility of urban displacement

While public attention is typically focused on the minority of forced migrants who are able to cross an international border and claim refugee status, the large majority of forced migrants remain within their countries of origin. The Unknown City project will develop fieldwork in Colombo, Dhaka, Harare and Hargeisa, working with people who are forced to move to these cities due to a variety of reasons including, political instability, environmental stress or extreme poverty.

The project will combine ethnographic research and community engagement with mapping techniques to empower transient residents in their claims to the city. Giving a voice to the experiences of forced migrants will contribute to changing ways of thinking, particularly through challenging perceptions.

The question of (in)visibility is crucial in understanding the lives of forced migrants as they often choose to remain hidden, yet this invisibility means they cannot access support and services.

This GCRF funded project brings together researchers from Geography, Architecture, and Anthropology, led by Prof Michael Collyer of University of Sussex, with Dr Nishat Awan providing expertise in mapping. The research will result in audio-visual outputs which will be brought together in an exhibition at the Royal Geographical Society in London.

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Supporting longer independent living

Population ageing has been recognised for some time in Europe, however, it has been acknowledged in China only recently but with more urgency due to the tremendous population size and predicted growth. An international network of researchers in the UK, France and China are investigating current long-term care delivery models for older people.

In a 3-year venture, funded by the ESRC, ANR and NSFC, researchers are working with people who are over the traditional retirement age to find new and innovative ways of adapting a person’s home so that they can live independently for longer. The project aims to help older people avoid going into residential care as well as making it easier for them to access public health and social services.

Professor Karim Hadjri explains: “This project is focused on meeting older people’s needs in terms of long-term care by exploring the relationships between living arrangement and living environment, and the design of care delivery from technological, financial, political and social considerations. These are key aspects that will inform housing choices for older people and drive future care delivery policy and practice. Likewise there will be increasing need for housing adaptation to support ageing-in-place and provide specialised and supported housing for older people.”

The findings will identify common features for ageing-in-place and integrated care under different policy and social circumstances and provide comparative studies that will inform recommendations to benefit China and Europe.
Over recent years decarbonisation has been a prominent part of UK Government energy and environmental policy. The AHRC funded Stories of Change project experiments with new ways of thinking and talking about energy system transformations, encouraging a more imaginative approach to current and future energy choices.

Stories of Change is led by Professor Joe Smith of The Open University. The project is working in three strands or 'stories' which explore the policy backdrop to energy change, the relationship between energy, industry and landscape, and communities that have been made and remade by their relationships with energy production. The Future Works strand, led by Dr Renata Tyszczuk, has gathered communities at a series of factory sites to develop accounts of past, present and future energy system changes as they affect the workplace.

Dr Renata Tyszczuk explains "We have worked closely with factories in the East Midlands, creating events and workshops that have included a wide range of people involved in industry. Our students have worked on projects imagining alternative energy futures for the cities of Derby and Sheffield and also on Live projects supporting collaborative making with museum and industry partners.

Our stories are gathered together on our online platform so that other researchers and organisations can hold their own material there and users can pick up a selection of the content and thread it together to create and share their own energy story."

People on the cusp of retirement are keen to downsize but a significant shortage of good quality, adaptable and accessible housing is preventing them.

There are currently almost 20 million households in the UK in the over 55 age bracket, and the number of people aged 85 and above is set to double over the next 20 years. However, much of the UK's new housing stock is being built with younger families and first time buyers in mind. This is resulting in a substantial shortage of accessible and suitable housing options for older buyers.

Researchers in the School of Architecture and Department of Urban Studies and Planning working on the Designing for Wellbeing in Environments for Later Life (DWELL) project developed a new approach to age-friendly housing by working with older residents and potential downsizers as co-designers.

They found that while there is no one 'ideal' downsizer home, there were a number of common features including manageable outdoor space, demand for fewer rooms but more space and flexibility, and a preference to live in mixed-age developments and communities.

My practice-based research is set in Berlin-Neukölln and considers how commons initiatives can further civic participation and citizen cohesion towards more resilient neighbourhoods. I am interested in finding out how to foster and sustain people's engagement in their communities by showing the rich possibilities a commons-perspective offers for our everyday lives through design and spatial practice.

The commons and their re-building are the leading narrative of this research as a framework for an emergent culture of mutual respect and care amongst agents of self-organisation and cooperation. My research involves interviews with activists and theorists, conversations with local community initiatives and the collaborative development of a local project space called 'Commons Lab'. This lab will explore different spatial notions of the neighbourhood to interact with residents and other stakeholders on different levels in its co-creation.

So far, I have done some reading and writing, visited local events and international conferences, and engaged in an activist group. I have started talking to some of the initiatives in the neighbourhood and conducted a few interviews with economic experts. I aim to publish my research outcomes throughout the process in accessible non-academic ways, so I am thinking of how to edit this into a collaborative zine or exhibition that could take place in Neukölln.
Supporting research into the socio-political dynamics and implications of space production by operating across different locations, scales, contexts, and cultures, with varied expertise and approaches.

The relationship between education, citizens and the design of cities will be explored in a new research project, Urban Education Live. Researchers are working with partners in Finland, Romania and Slovenia as they set up local hubs in locations across Europe.

Urban Education Live is a three-year project funded by the ESRC as part of the EU’s Joint Programme Initiative ‘Smart Urban Futures’. Partners will use their hub to work with local communities, schools, NGOs, businesses and councils to imagine new and inclusive futures for our cities. The project builds on the long-term relationship between the School of Architecture and the city through many years of innovative teaching and research. It will utilise LiveWorks which is the School’s Urban Room in Sheffield City Centre, where local people and organisations can learn about our civic engagement activities, suggest and collaborate with us on Live Projects.

Dr Tatjana Schneider explains “Each partner will start by mapping of their local areas by examining the buildings, infrastructures, facilities, social and spatial amenities as well as other initiatives, collaborations and networks. This mapping will provide the basis for further engagement with the city through a number of teaching activities where students and academics will work on collaborative projects and undertake design work and research addressing certain challenges the city is facing. Local hubs will act as corner-shop-type spaces in the cities which we will use as work-bases for embedded and situated learning.”

Carolyn Butterworth explains “We are very excited about the possibilities that this project will bring to our engaged teaching and research. Urban Education Live in Sheffield will set up creative dialogues between students, academics and local citizens so that all can contribute to the making of a more inclusive, sustainable and dynamic city. As well as making a difference at a local level, our students will also be able to connect with and learn from the wider European network.”

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The housing crisis is one of the UK’s biggest domestic policy challenges and of intensifying international urgency. A complex set of factors, including an upsurge in the price of land, the low number of houses built in some areas of England and a growing population have all contributed to an increasing inequality in housing affordability.

A project funded by the British Academy and led by Dr Tatjana Schneider is now looking into German examples, the research will look at the opportunities for the translation of these cases into UK policy and practice and, by doing so, prevent the kind of civil unrest which might otherwise lead to inequality and social exclusion in an attempt to halt the kind of civil unrest and political disempowerment that it could also lead to.

By investigating the specific Swiss and German examples, the research will look at the opportunities for the translation of these cases into UK policy and practice and, by doing so, contribute to current debates around wider global questions on housing inequality.

In Malaysia, the law does not allow for two unrelated people, while at least one of them is Muslim, of the opposite sex to be closer to each other in public than the so called ‘suspicious proximity’. This research aims to find out where young, heterosexual people date and how the tension between social expectations and individual practices influence what young people do in public spaces.

By observing places where young people meet and how they behave, researchers can question the notion of 'public space' as a Western construct which is not really valuable in understanding spatial practices in Malaysia. The project will allow us to better understand the use of spaces in Kuala Lumpur which could lead to better design of these spaces. It is hoped that it could also lead to a new theoretical framework to discuss spaces in a non-Western context beyond the division of private and public space.

This research continues previous work by Dr Krzysztof Nawratek in Kuala Lumpur and will be developed further through a collaboration with colleagues from the University of Leeds, Centre for Religion and Public Life. Dr Nawratek aims to publish research discussing the typology of places where practising friendship between males and females is safe in public spaces in Kuala Lumpur.

Inequality is an issue for all cities around the world, but the degree of inequality varies from one city to the next and is strongly related to the political agenda. Like most other major cities in the region, which have taken Dubai as a role model, Amman has experienced a variety of projects as a result of surplus capital from the gulf which dramatically transformed the traditional public spaces. Amman became a socially divided city. My research explores possible solutions to inequality and social exclusion in an attempt to halt the kind of civil unrest and political disempowerment that it might otherwise lead to.

My research reflects on residents’ narratives, collected in selected open spaces. The study proposes a framework for the re-claiming and re-production of public space through performative practice, as an attempt to reflect on social exclusion and inequality in public spaces in Amman.

My practice-led research asks how forms of performative interventions can help to understand inclusion, exclusion and the conditions for reclaiming public space in Amman.

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My approach is based on different disciplines including social, spatial and political theories, which I translate into a performative spatial practice. These interventions were based on feminist theories to both disrupt power structures and reveal power inequalities.

My research focuses on the relationship between the University and its urban environment, specifically focussing on the role of the University of Baghdad campus as a place maker in the City. By examining the urban transformation of Baghdad and its political, cultural and economic conditions I aim to map all the significant changes that faced the University campus from its foundation.

The relationship between universities and their cities could offer a wide range of opportunities for local communities by creating an integrated, social, cultural environment that not only supports the university but also the city.

While studying in Sheffield I have been able to focus on the University as a key player in the city. As an architect and academic, I am able to question if the University campus has a role in placemaking and examine if this role has changed. I ask if the vision of the University as an education institution is influenced by urban changes and how the University interacts with its urban environment.

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My research focuses on the relationship between the University and its urban environment, specifically focussing on the role of the University of Baghdad campus as a place maker in the City. By examining the urban transformation of Baghdad and its political, cultural and economic conditions I aim to map all the significant changes that faced the University campus from its foundation.

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Our work with key partners, from academia, architectural practices and professional organisations to community groups and regional authorities, keeps us at the forefront of innovative architectural research. We are always looking to build new collaborative research relationships. If you would like to discuss working with one of our research groups or academics on a future research project please contact us.

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