PEARL
Person-Environment-Activity Research Laboratory
The PEARL Vision

Creating a world where everyone can achieve a better quality of life
PEARL – Basic Concepts
People and Environment: Infrastructure and Cities

- Cities are not buildings and infrastructure, they are people.

- The buildings, infrastructure and other systems develop around people in order to support their attempts to meet their aspirations.

- Over many years, in cities around the world we have been looking at cities from a more human perspective: a person whose capabilities allow them to see, hear, touch, smell, taste, feel their environment.
People and Environment:
Infrastructure and Cities

Drawing on the experience of cities, such as Medellín, Colombia, which have made successful transitions in the quality of life of their inhabitants, we developed a simple approach to help other cities consider their future.

We call this the ‘5-cities model’ and it gives a set of basic high-level aims which can be used to guide decision-making at community and city level.

The 5-city model is attracting interest in several countries and communities around the world as a way to start the process of change.

The 5-city model shows five main principles for a city to use to guide its decision-making. The city is people. The city should strive to increase mutual respect of its inhabitants, to ensure there are sufficient activities to enable its people to meet their aspirations, and that these must be accessible to all, that inhabitants sense that they own, and take responsibility for, the public realm, that the city promotes health, and that it can adapt to meet the needs of future generations.
The accessibility of a city to people is based on our Capabilities Model, which is based on Sen’s concept of Capabilities and Functioning, where a person’s ability to Function depends on the Capabilities they are required to have by the environment.

So the Capability Model has two types of Capability: Required Capabilities, which are required by the Environment (e.g. the ability to climb a step) and the Provided Capabilities of the person (e.g. the ability to maintain balance whilst lifting one leg). Accessibility is the relationship between these two Capabilities.

The Capability Model works by comparing how people can do things compared with what they are required to do by the environments they encounter. It also allows us to study the ability to ‘cope’ – use a different way to achieve an outcome. One of the crucially important parts of the model is that it sets the outcome as the achievement of an activity, rather than ‘just’ completing the particular task (so climbing a step is not the outcome – this is reaching and doing the desired activity – but an inability to do so could prevent the outcome. The balance between Required Capabilities and Provided Capabilities can also change, according to changes in design of the environment or changes in the person.
The way a person knows about their capabilities is through their senses. People use many senses to combine the information coming from the environment into a kind of multisensorial ‘symphony’, that they compose all the time, and that helps them relate to the environment.

To understand cities we need to know how these ‘symphonies’ work – from the environment which is transmitting the stimuli to the neurons that are processing the responses. Understanding this enables us to design and operate cities and infrastructure so that people can create a better society for themselves – and everyone.
People and Environment: Why do we have senses?

- Senses are the pathways through which we perceive the world. We commonly think of five senses: vision, hearing, smell, taste, touch. However, we have many more senses: we are currently working with 33 senses – including the senses of balance, pain, rhythms, dissonance, fairness, culture, self...

- Senses have evolved over many years, but generally slowly. Humans evolved as animals of the savanna – with a vision system capable of identifying a small object far away so that it could be identified as something that could eat us, or that we could eat. We have a hearing system that is similarly capable of detailed hearing.

However, we now live in cities – no longer the wide open savanna spaces for which we have evolved, but now closed in by walls and buildings, with traffic and other industrial noises and hard surfaces. This puts us under great stress.
PEARL is designed to study the way people use senses in the environment. We can control the environment in PEARL in a number of ways so that we can see how people use their senses to understand, interpret and perceive their immediate environment.

In this way we can work out how to design cities that work better for our senses and cognitive processes, especially in terms of multisensorial combinations of senses, so that we can understand how we cope with sensorial changes (for example, as we become older) and how we can have a city in which we feel comfortable and able to live with a good quality of life.
PEARL’s Purpose

- PEARL’s purpose is to draw on international experience and core science to allow us to explore these sensorial interactions between the environment created by infrastructure and cities – including buildings, transport systems, public space, people – and the people who want to live, work and enjoy the ambience of their urban space.

- It is that connection – between the ‘big picture’ of the city and its vision of a better society (e.g. the 5-city model) and the ‘micro-picture’ of the way in which neurons and other body processes respond to these stimuli (the Capabilities Model) – that is unique to PEARL.
So to understand how to tackle this multiscalar problem, we have to embrace a whole range of scientific disciplines—from the study of neurons, through to the study of how traffic interacts with people.

This is why PEARL is such an extensive facility—it is only by studying the interactions between these scales that we can begin to understand how to create cities so that people can enjoy them.

The big-scale stimuli are met with tiny-scale response pathways that provide the connection between the environment and the person’s actual life, so we need to be able to represent the city at the whole range of scales in order to capture this and study it.
PEARL allows us to explore the science to combine these fields to improve the city.

**Senses**
How the pre-conscious brain responds to multisensorial stimuli to evoke perceptions on which people base their sense of environment and self.

Current research in Neurology, Ophthalmology, Audiology, Haptics, Olfaction, etc.

**Capabilities**
How a person responds to the challenges of the environment as they have perceived and experienced it.

Current research in Orthopaedics, Biomechanics, Vision, Hearing, Environments, Music, Dance, Multisensorial perception

**Personal/Social space/Social Space**
How people and the environment interact with each other - individually

Current research in Behaviour, Human Factors, Urban Design

**Public space**
How people and the environment interact with each other – en masse

Current research in Human Factors, Behaviour, Architecture, Engineering, Planning
HISTORY
History

- PAMELA (Pedestrian Accessibility Movement & Environment Laboratory) is an experimental facility hosted by UCL's Centre for Transport Studies Accessibility Research Group. It opened in 2006, initially funded by an EPSRC grant.

- Initial work studied streetscapes with different lighting and noise environments, to understand the perspectives of older and disabled people.

- Interest sparked immediately in the Institute of Ophthalmology for the possibilities of testing therapy performance in street environments and this wide-ranging use of the facility has continued ever since, involving many departments in UCL.
History

- PAMELA was soon being used by commercial clients for testing railway capacity at stations on the Thameslink upgrade

- Increasing amount of work on wheelchair design and operation in street environments

- Continual use for consultancy work related to streets, including Exhibition Road, London Underground station platform humps, LUL Deep Tube Train, HS2 etc.

150 participants simulating peak hour station conditions in an experiment for the Department for Transport and Thameslink
History

- PAMELA is in constant use on a wide range of projects, many of them multidisciplinary approaches to other research being carried out by researchers across UCL, such as Vision for people with dementia, hearing aid development, spatial memory, Parkinson’s disease.

- Undergraduate, MSc, PhD projects have been undertaken in PAMELA, as well as MSc modules and Undergraduate Scenarios for more applied teaching.

- Within UCL, PAMELA has worked with Anthropology, the Bartlett, Institutes of Neurology, Ophthalmology, UCLEar Institute, Mechanical Engineering, Institute of Orthopaedics & Musculoskeletal Sciences, Sports Medicine, UCLIC and the Institute of Biomedical Engineering.

- Several papers based on work undertaken in PAMELA have been published in a variety of different fields, including Ophthalmology, Engineering, Transport, urban design, biomechanics, neurology, clinical practice, have been cited over 2,000 times and have won two distinguished prizes (2015 Ruskin Prize for best paper in Vision Sciences, James Hill Prize (Journal Prize for best paper (Municipal Engineer)).

- PAMELA has attracted over £20m funding since 2003.
Why PEARL?
Why PEARL?

- PAMELA has run out of capacity – there is a 6-month lead-time for use of the laboratory. This delays science and education and has lost us commercial work.

- PAMELA needs better, new and different facilities to meet the demand of researchers from other fields with interests in how people interact with the environment, so that we can extend the transdisciplinary vision inherent in our philosophy.

- PAMELA is too small for some experiments, so we need a larger facility to respond to clients’ needs.

- UKCRIC (UK Co-laboratorium for Research on Infrastructure and Cities) is a £400m programme of research capability enhancement in 15 universities, led by UCL, to provide evidence-based advice to government about how best to use its programmed investment of £several trillion over the next few decades in infrastructure and cities.

- PAMELA is too small to meet its UKCRIC commitments, so needs to be replaced by a larger facility. This will be the PEARL facility.
Why PEARL is so important

PEARL is the only laboratory in the world that will enable detailed person-environment interactions to be researched in depth and at life-scale in the context of real-world infrastructure and city design.

PEARL is ideal for investigating how people interact with railway station platforms, train-platform interfaces, concourse & ticket gate systems design, trains, traffic, street infrastructure, safety-related systems, such as pedestrian crossings evacuation routes, effects of aircraft, train or traffic noise, accessibility and aesthetics.

In addition, PEARL is an environment in which new ideas can be tested safely to reduce the number of options to be tested before installing the most successful ones in the real world for trials.

Because PEARL will also be a 600-seat ‘theatre’ it will be possible to demonstrate options to civil servants, local authorities, planning inquiries, the general public, at life scale and realistically, thus reducing problems from imagined effects of infrastructure investment.
Why PEARL is so important

PEARL will enable better public representation and participation in major infrastructure projects by enabling people to have a much better understanding of what is actually meant in project proposals – and what these really mean for people who will be using them or being affected by them.

This will save a lot of money because planning processes will become more efficient and effective as a result of better understanding by both proposers and objectors of major schemes.

PEARL will allow different options to be explored at life-scale. We have already seen changes to train and street design as a result of work in PAMELA and this can be accomplished much earlier in the design process, much more quickly than in the real-world environment and with much greater attention paid to detail.

UKCRIC is about the future of infrastructure and cities: PEARL provides the understanding of the societal interface to enhance the acceptability of future projects.
Why PEARL is so important

But perhaps the most important thing of all is that PEARL represents a whole new way of integrating university researchers with the communities in which they work.

PEARL is designed to be porous so that people feel they can be involved in and contribute to the development of their community.

Not only is it a world-leading scientific research facility but it is also a local community arts and education place.

We are designing a new way of working so that community events can happen around the science, so that people in the community can feel less intimidated by words like ‘research’, ‘universities’, ‘science’, and people in the university can feel at ease with the world around them.

PEARL is the opening of a dialogue that will enable us to create better world for the future.
PEARL & UCL
Meeting the 2034 Strategy
PEARL's predecessor, PAMELA, is already acknowledged as a world leader in people-environment interactions.

The PEARL team is shaping new ways of research in ophthalmology, neurology, audiology, orthopaedics, architecture, urban design, design for performance, engineering ... … and also in raising new questions for research in railway infrastructure, train and system design and operation beyond current preconceptions.

... driving new approaches to the design and composition of urban space to meet the needs of more creative city visions.

... stimulating new teaching and educational techniques which use space and environment more creatively than the conventional university environment.
Integrating research & education

- PEARL will be able to teach transdisciplinary thought techniques based on involvement in action research.
- PEARL will educate across the university and into the local community.
- PEARL will host transdisciplinary scenarios for students across UCL to develop their thinking about the real nature of problems.
- PEARL will offer facilities for new degree programmes using hands-on, in-house, experience and training in transdisciplinary education and research.
Global challenges

- PEARL will host and drive challenge-based scenarios for students and staff to tackle design issues for massive global problems – e.g. dementia, autism, accessibility, intercultural understanding, sustainability, equity & justice

- PEARL will enable the bringing together of fundamental research and practical application of its benefits in society

- PEARL will help cities across the world to develop environments better suited to the needs of their local people

- PEARL will help communicate the implications of urban design to the people who will need to carry out their lives there in a meaningful way

PEARL will be a prime mover in addressing global challenges for cities and their population
Accessible publicly engaged institution

- PEARL will be based in the heart of a local community
- PEARL will be designed to be porous – encouraging local people into the facility rather than keeping them out
- Strong local engagement through the creation of a local social enterprise to strengthen engagement between the community and the facility
- PEARL will work with local groups to encourage local people to share their problems and thus create new research questions
- PEARL will work with Elutec to create a sustainable urban design apprenticeship scheme
London’s Global University

- PEARL will work closely with the local authority to develop better urban realm design.
- PEARL will engage actively with the NHS/PHE Healthy New Towns Demonstrator programme, especially in London.
- PEARL is working with Transport for London’s Innovation Team to develop a close working research relationship.
- PEARL will work with London First and other business organisations to create a better link between research and business.

PEARL will be a creative resource for London, enabling Londoners to benefit from the research it conducts.
Global Impact

- PAMELA is already internationally recognised as a place of excellence. We will work internationally, using PAMELA’s strong international networks to build greater interactivity across the world through PEARL.

- PEARL will develop and extend its existing collaborative research activity with DAC countries to improve their urban development.

- PEARL will use new technologies to improve international involvement in its research activity.

- PEARL is unique and is already attracting attention world-wide for collaboration in research and education.
Faculty Strategies

- FES will be able to use PEARL for pan-engineering scenario teaching and cross-departmental research.
- PEARL is an example of engineering thinking being applied to generate ingenious solutions to a complex problem.
- PEARL will enable environmental interaction engineering and architecture to be tried and tested at life-scale under controlled conditions before more public applications.
- PEARL will facilitate start-ups in environmental design for people who wish to implement their university education in this in relation to the way people live in cities, from whatever background within UCL.
Institutional need

- Grand Challenges have encouraged transdisciplinary research, but ...

- ... penetration is not universal across all faculties, departments or staff

- PEARL will provide more facilities, teaching and support for transdisciplinary research, leading by example

- PEARL will enable UCL to live up to its intentions about multidisciplinarity by facilitating action

UCL is ambitious about multidisciplinarity, but action is sometimes less evident
Long term beneficiaries

- UK Government National Infrastructure Commission: PEARL will inform the NIC through UKCRIC about person-environment interactions with infrastructure and cities.

- NHS/PHE: PEARL will provide life-scale testing and experimentation on health benefits from changes to infrastructure design – e.g. falls cost NHS £5.5m/day. PEARL will help to reduce that.

- Local communities: PEARL will enable local people to understand their environment better and create a better quality of life.

- PEARL has a strong international activity and is a unique resource for researchers and practitioners around the world.
Example projects
One of the problems with noise is that few people actually understand the science: what does a certain indicator – e.g. dBA – actually mean to the people who have to live with it?
Example projects

- In November 2016, the UK Government approved two major infrastructure schemes: the expansion of Heathrow and the development of HS2. In both cases there are severe and controversial problems in relation to the local communities affected by the infrastructure. A particular issue is noise.
Example projects in the pipeline

Carrying out tests on the functionality of sensors for observing city centres and how they work for the people using them. This project, called CORONA,(City Observatory Research platfOrm for iNnovation and Analytics) will be based in Newcastle, with other sites in Sheffield and Bristol, Birmingham, Manchester and Cranfield Universities but the technology will be tested in PEARL.

How pedestrians are modelled for the process of designing pedestrian facilities is a highly complex affair, but it is essential for better design for people.

PEARL will be the site of experiments to develop and test completely new ways of simulating pedestrian behaviour in computer models which will inform the design of pedestrian spaces, such as city centres, stations and airports. This is in association with Queen Mary University London, UCL and Exeter University.
Example projects in the pipeline

Zebra crossings are well known features of the urban landscape, but their lighting still refers back to concepts and assumptions thought up in the 1930s. We are involved in developing a project to revisit this, using a driving simulator in Sheffield University and PEARL’s capability to build a full-size two-lane two-way street, light it with different lighting designs and test it with people. The driver’s perspective derived in Sheffield will then be combined with the pedestrian’s perspective learnt in PEARL to create some options that will then be demonstrated in PEARL.

Apart from the science and engineering associated with the lighting system and consequences for road safety, this project is hoping to accelerate the process of getting research out of the laboratory into the street. Because PEARL has the capability of being a ‘theatre’ and can demonstrate results to a large group of people, we will be able to invite regulators, civil servants, local authorities, engineers, architects, planners and the general public to see the different proposals for themselves.
Example projects in the pipeline

People with hearing difficulties represent a large proportion of the general population, especially among older people. Often people do not realise their hearing is becoming impaired, but they do find some activities increasingly difficult – such as being with friends in a restaurant, coping in complicated places like railway stations or airports, city streets and so on.

We have been involved in a project called OverHear, which is a network of audiological researchers and clinicians from around the UK (including the Ear Institute at UCL and associated UCL hospitals) who are interested in how hearing works in the world outside the clinical environment. We constructed a Pizza restaurant in PAMELA to help figure out what the problems really were.

We are now working on developing this – more work in the restaurant, but also in railway stations, airports and streets using the PEARL facility and its ability to be configured for any of these environments at 1:1 scale.
A group of UCL psychologists, neuroscientists, architects, computer scientists and engineers is creating a doctoral training centre called “Ecological Brain”. The term “Ecological Brain” refers to how the brain responds to stimuli in the real world, as opposed to responding to stimuli generated in artificial and highly controlled circumstances in research laboratories.

The problem is that the “real world” is very complex and uncontrolled, so studies are very difficult, for example, because of unplanned noises or other events.

Using PEARL we can create simulations of real world environments, including the lighting noise and smell so that the researchers can learn how the brain responds to stimuli in broader environments than the typical psychology experiment situation, but without the uncontrollability of the actual environment.

The Centre will train doctoral researchers who will proceed into a number of professions, including clinical and research psychology, architecture and engineering.
Example projects in the pipeline

Since the concept of urban design started in the oldest cities, the dominant mode of expression has been visual. Through many styles, ages and concepts, the visual appearance of the city has been of paramount importance in urban design and planning.

However, the human being does not only perceive the city through their eyes – indeed some people cannot do this at all – but use other senses to inform their perception of the place where they are.

We are developing a project to take place in PEARL which will explore these multisensorial approaches to urban design, using music and dance as examples of different ways of perceiving space and time and then learning how that impacts on the way we design space for people, so that we can encourage better social cohesion and quality of life.

For this we will construct a series of urban spaces and create designs based on people’s perceptions of space and time through their sense of hearing, balance, and rhythm as well as sight.
Exemplar projects

- PEARL will be able to demonstrate the noise generated by infrastructure projects under various controlled conditions and test various mitigation scenarios with members of the public.

- PEARL can show the actual noise levels and effects of different solutions to the public, engineers, planners and politicians so that more acceptable designs are generated.

- Apart from improving the project itself, this will make the time and money spent in public inquiries much more effective, by demonstrating impacts for real, rejecting inappropriate solutions quickly and helping to refine workable ones before and during the inquiries.
Exemplar projects

Over a lifetime, a person could make around 250 million footsteps. For our work in the Healthy New Town, we are investigating the potential of different footway surfaces to make those steps more comfortable with the objective of reducing falls and the impact of falls if they were to happen.

We are testing softer surfaces and different surface profiles to see how gait changes, the extent to which damage to the skeletal system might be reduced and to see if we can help improve the balance system over the course of a lifetime’s walking.
Functionality
Representing whole environments

- PEARL will represent whole environments at 1:1 scale:
  - Trains and platform, including island platforms, platform edge doors
  - Station concourses, ticket barriers, passenger routes
  - Street environments, both sides of a street, interfaces with buildings, sightlines
  - Airport jetway-aircraft interfaces, security systems
  - CCTV and data collection testing in real environments

Image taken by Andrea Vail from the Londonist Flickr pool.
Representing whole environments

- **Lighting**
  - Full simulation of lighting intensity from 0 to 10,000lux
  - Full programmable colour temperature system, to represent daylight and artificial lighting under controlled conditions
  - Dynamic control of lighting to allow programmed light changes
  - Full variability over the entire surface

16 lux lighting level for gene therapy experiment (IoO)

Spatial Memory experiment with plain white light with yellow tinge (IoN)

Instrumented wheelchair, seen under low-pressure sodium lighting

Blue lighting setup with complex shadows for dementia experiment (IoN)
Representing whole environments

PEARL can represent different acoustic environments:

- Ambisonic phased-array multi-driver acoustic system to represent different ambient sound environments
- Dynamic control over sound insertions
- 3D acoustic environments, e.g. aircraft at different heights, traffic moving around the space, trains entering stations...
- Sophisticated point source locatable sound system
- Range from 0-150 dB, 30Hz-20KHz

Experiment testing complex gradients on station platforms for London Underground, in this case, with people with reduced vision capabilities. The complexities of negotiating complex environments under high levels of noise is a current line of research.
PEARL includes olfactory environments:

- Multiple combinations of smell sources
- Programmable dynamic treatment of smell over space and time
- Combination of lighting, sound, smell and touch to create holistic environments
- Multimodal approach to smell and other senses
- Multisensorial design testing capability
Clinical research and the environment

- PEARL will continue and expand research into interactions between the environment and...
  - RPE65 (Prize-winning work on Leber’s amaurosis)
  - Peripheral vision
  - Dementia and vision
  - Hearing assistance development
  - Place cells and spatial memory (following O’Keefe’s Nobel Prize-winning work)
  - Orthopaedic assistance

Monitoring Spatial Memory experiments
The Barking Riverside HNT will incorporate PEARL as a research base:

- Demonstrate how a vibrant young community can meet health needs in the context of ageing and dementia
- Community-driven research
- Combination of in-laboratory and in-field research to deliver new outcomes rapidly and effectively
- Link to other NHS Healthy New Town Demonstrators
- Integration with new and existing transport system

The Barking Riverside HNT will be a new local community, with 10,800 homes and systems, including a new railway line and bus services. This will provide PEARL with a semi-controlled exterior environment to support the research and teaching.
How this all comes together

- PEARL is **multiscalar** – working from the scale of neurons to the scale of cities – and **multisensorial** – studying combinations of senses as well as the capabilities of each one in the environmental context.

- PEARL will be available for people across UCL who have an interest in how people engage with their environment.

- It will be the best transdisciplinary base for conducting research across disciplinary boundaries.

- PEARL will enable us to combine neuroscience with sensorial research ... with engineering, ... with music, ... with architecture, ... with psychology, ... with anthropology, ... with population health, ... with design, ... (the list is endless!) ... so that real understanding of real problems can be gained and more appropriate solutions understood.

- The synergy of working with the Bartlett, including the DPU, with its international reputation in this space, and then combining this with the sensorial Institutes, with Population Sciences, and with Brain Sciences etc. is a good example of how UCL can make a real difference in the world.

- PEARL will enable life-scale experiments and tests to take place, not only to try out ideas in architecture and engineering, but also so that the other disciplines are involved and help to reduce the inevitability of unintended consequences, whether physical, technological or social, of urban design. It will complement the multisensory environment planned for the Bartlett at Here East.

- We know from PAMELA that nobody who interacts with PEARL will come away unaffected by the breadth and depth of the experience it offers. It will change their lives – and those of many others as a result.
PEARL and the community
PEARL and the community

- PEARL is designed to be very different from the usual university laboratory.

- Instead of being hidden behind locked doors, PEARL is designed to ‘live’ in and with the community – the default will be that people are welcome to come into the facility, enjoy the café, chat to researchers, share their ideas and discuss the challenges the environment imposes to them.

- These interactions will turn into research questions which the research team can then investigate.
PEARL and the community

- Of course, sometimes, for ethical, scientific or safety reasons, part of the laboratory might need to be closed to general access, but the general principle is that the facility is open to the general public.

- Our researchers will be trained in public engagement skills and will be willing to explain their work to people and listen to their views.

- We will be especially happy to organise visits from schools to see how such a facility works and how universities can help make the world a better place.
We have used music and dance successfully to communicate our work with the general public and PEARL is genuinely open to trying new ways of explaining what we do to new audiences.

The PAMELA facility is accustomed to having students from many different parts of UCL and other universities, so that artists, film-makers and musicians can use the facilities for their creative work.
PEARL and the arts

- The arts provide a really important and effective way of communicating with a wide variety of audiences and communities and PEARL will be able to host events and exhibitions from the university as well as the local area.

- In 2014, we hosted a Leverhulme Trust Artist-in-Residence in PAMELA, which culminated in an art exhibition and performance in the laboratory. We expect to encourage more such interactions in PEARL.

Performance sculpture Malleable Architecture, by Zoe Schoenherr; performed at the PAMELA facility by Holly Thomas

Induction Loop, drawings Zoe Schoenherr; sonification Sara Adhitya; dance Kaajel Patel
PEARL and the arts

- The uniqueness of the PEARL space and its equipment – especially lighting and sound systems – means that it is an ideal way to bring arts and sciences together.

- As a performance space, theatre, or gallery, there is a great opportunity to work with experimental arts and performance to explore what can be achieved to push the boundaries of performance art.
PEARL and the arts

We really want to explore what we can do in terms of creating new art, by combining different modes of thought from the arts, sciences and engineering. We are especially interested in creating new kinds of performance, whether this is about a space such as a “prepared concert hall”, or enabling people to create their own performance spaces within other environments.

Combining this with our work on time also gives rise to the idea of creating “performance time” – how we can stretch or shrink time through performance so that people perceive their environment differently.

Stretching time: a bus stop designed to enable people to create their own music as a collaboration with others. Some people spent several hours playing with this bus stop. This was part of Transport for London’s Year of the Bus event on Regent Street in 2014.
PEARL and the arts

We are exploring with the MARCEL Network in France the concept of multicasting technology so that we can bring experience of the space directly to people beyond the PEARL space itself.

The multicasting technology enables direct communication between different places – someone in France could control the lighting or sound systems in PEARL and groups could work together directly on the same work of art, scientific article, experiment or live performance.

Experimental sound studio in La Fonderie, Le Mans

It would be possible to perform a play – or an experiment – in two places at the same time.
PEARL and the world

- We are developing a series of ‘pop-up portals’ which will enable researchers to engage with local people about their issues with public space and relay these directly to the laboratory – or to relay outcomes from experiments back to the people in the portal. Our first pilot pop-up will be in the Barking Riverside Healthy New Town Demonstrator.

- The multicasting technology will also enable us to communicate directly with other groups all over the world.

Discussing research ideas and outputs with the community in Santiago, Chile

Community participation about the design of their neighbourhood (La Habana, Cuba)
PEARL and education

PEARL will be a great location for people of all ages to learn about their built environment with hands-on experience of how it works and could be changed to make people’s lives better.

We are planning a ‘People’s Environment School’, modelled on the principles of the Danish People’s High Schools where the spirit is that everyone learns, and everyone can experience ways of making a difference and the concept of ‘subjects’ is left behind so that real understanding of our environment is relevant to the people who live in it.

‘Mi plaza es +’ (‘My square is more’), Havana, Cuba, 2017

Bringing together people from across the area – local residents, businesses, schools – and students, staff from the university is a great way to enable challenges to be understood by everyone.
PEARL and education

PEARL is a great facility for local schools

PEARL is an example of a university research activity, but we believe it is really important to show school students of all ages that it is open to all, that university research is not stuck behind high walls and closed doors and that it is of relevance to their problems and challenges.

So PEARL will be open for visits from schools either just to see what we are doing or to have activities there as part of the normal teaching curriculum.

There will be opportunities to try out experiments and other activities about the environment and transport systems and ask those questions you never thought to ask – how does the colour of light change the way you see? How do different places sound? How can we design a better train? And by looking at these in practice it is possible to learn about how science and engineering fit with society, how methods are important and much more!
PEARL and education

We are planning two new Masters programmes which will run at the PEARL facility

**MASc: Decision-making**

This programme is a highly innovative approach to multidisciplinary decision-making, based on new learning models.

It involves extensive inputs from world-renowned decision-makers in a number of fields, who are renowned for bringing multiple strands together to find a solution to a complex challenge.

**MSc: City curation**

This programme is a new take on the concept of planning.

The concept is that a ‘city curator’ looks after a city, learns about its inhabitants as well as its history, seeks to work on developing a narrative to take the people forward towards the future and then creates the city that will make that story real.
PEARL and education

PEARL will also host parts of existing Undergraduate and Masters programmes

**MEng/BEng Engineering (Civil)**

These programmes are well-known to be radical civil engineering programmes, including a lot of hands-on group work and design.

PEARL will be able to host the scenarios – major problem-based challenges – related to urban design so that students can have a real feel for what happens – and what can be changed – when designing an urban environment.

**MSc: Transport**

This programme is run jointly with Imperial College and some of the optional modules are concerned with the design of urban spaces and accessibility.

By enabling students to have a practical hands-on feel for urban design they will learn how to develop better and more accessible design approaches.
PEARL and education

PEARL will also host elements of doctoral education in a number of fields:

**PhD in Transport/Engineering**
The availability of a resource as unique as PEARL will excite a lot of doctoral research on the design of urban space and transport systems.

With the availability of configurable space at a scale that enables life-size experiments to take place, this will be a golden opportunity for students wishing to push the frontiers in these areas.

**PhD in other areas**
PEARL provides life-sized environments, but under controlled conditions, for research in neurology and psychology related to environments and navigation, ophthalmology, audiology, orthopaedics – basically any research challenge where the study involves interactions between people and the environment.
We feel that there are too few ways of engaging in the communication of design and composition that move beyond the traditional conference or exhibition. We want PEARL to help us change that.

Conferences
PEARL has 600 moveable seats, platforms, lighting, acoustic and physical setups...

PEARL could host conferences where the emphasis is on ‘showing’ and ‘trying-out’ rather than ‘telling’.

In addition to the PEARL facility itself, the site has catering facilities and a hotel is being built nearby so it will be a great facility for such touch and hear kinds of conference.

CPD
CPD activities are really important if we want to change the way cities and people live and work together.

PEARL will be able to provide real hands-on life-scale activities as part of CPD education and training activities.

Our approach at PEARL is that people should “hear, see and do” so that they understand as well as just learn.
PEARL and employment

- PEARL will be hiring a number of people to work in the facility – researchers in a variety of sciences and the arts of course, but also the people we need to enable the laboratory to function – carpenters, metal-workers, etc. - or develop skills in electronics and instrumentation, to run the computer systems we need to carry out the data analysis we have to do, the design of the experimental environments – rather like theatre or film set design, lighting technicians, sound engineers and so on. Of course we will also need the administrative support, security and cleaning staff to keep the laboratory functioning.
We are investigating the possibility of creating an Apprenticeship programme in collaboration with local Colleges and schools and appropriate industries so that we can provide work experience, internships and opportunities for young people to gain employment both within the facility and elsewhere.
How does PEARL do this?
The PEARL facility

Details of the PEARL facility are still being worked out, but the site we are considering meets our needs in terms of space, interactions with the local community and prospects for doing both innovative science and engineering to improve urban design for the 21st century.

This will be a formidable facility, unique in the world and will provide immense research, educational and community benefits.

What PEARL might look like

AECOM in 2017 as part of their assessment of options for the site and adapted to illustrate a wider range of capabilities. The purple rectangle represents the size of the current PAMELA facility.
Capacity

- Several different-size laboratory spaces, from 2.3m² to 4,000m²
- Accommodation for up to 600 people in the facility
- Spaces can be isolated from each other in terms of acoustics, lighting and smell, allowing multiple simultaneous experiments
- Fast setup systems means faster turnaround between experiments, so more can be done more quickly
Laboratory space

- 100mx40mx10m clear internal space
- Configurable platform ~650m²
- Divisible into several smaller isolated spaces
- Sound, lighting, olfaction available in each space
- Pop-up seating around main space for lectures / demonstrations / public events etc.

Image of a large open-space building
Research and teaching space

- The office and teaching space will be flexible, so that it can be reconfigured as needs change, and which will be built in a building adjoining the laboratory space.

- It will enable all sorts of flexible uses and creative means of developing thought and ideas.

- The facility will include workshops and storage space to service the main laboratory space.

- The site will have a number of incubator units for start-up design/composition enterprises.

- The site will include a catering facility, maybe a health centre for the local community.

Example of a group working space in PUC Chile

(Very) flexible workspace in the E-square innovation centre, Osaka University
And how will we put this to good use?
University space

- Available for large teaching scenarios
- PEARL could create specific spaces – e.g. courtrooms, hospital wards, waiting rooms, street environments, stations, for teaching and research
- Incubator space for multisensorial design startups
- Interaction space for public engagement
- Examination space

Broadcast setup for Court of Appeal (BBC). PEARL could use a similar setup, but e.g. with facial image analysis system to study reactions to events in the courtroom.

From place cells in rats to people in urban space ... PEARL can make such research translations easier and quicker.
Community space

- Pop-up seating around a configurable platform to accommodate 600 people in-the-round, or proscenium form
- Access to catering facilities
- PEARL will be designed to facilitate interactions between the local community and the researchers to form new approaches to the definition of research projects
- These spaces will be made available for community use
Theatre space

- PEARL can be adapted for theatre, concert and other productions and public events
- Controllable acoustics
- Environmental controls
- 600 seat capacity
- Multicasting system (PAMELA is involved in a trial of such a system) will enable live performances to be created simultaneously across multiple (international) sites
- Multicasting system will also facilitate multi-way communications between PEARL and other UCL sites: e.g. UCL East, HereEast & Bloomsbury

Minneapolis Theatre in the round

King’s Place, London
In summary...
By examining how people interact with their immediate environment PEARL will enable us to work out how to create a world where everyone can achieve a better quality of life.

By delivering people-centred results to other infrastructure researchers in UKCRIC we can help to ensure that all infrastructure will incorporate people’s needs as a fundamental element.

By working closely with and in the community PEARL will be able to learn directly the needs of people in their daily lives and create ways to ensure that the environment is better suited to these needs.

By using its opportunities for education and research in a way that encourages and enables local people to become directly involved, PEARL will contribute to the local community through all its activities.
PEARL

- Is a flexible environmental laboratory which can adapt to requirements for research involving:
  - People and the environment
  - People and transport systems
  - Sensor testing within controlled environments
  - Materials testing with people in controlled environments
  - ‘Half-way-house’ experiments and trials for clinical advances
  - Contextual environments for teaching and research

- It is also able to support direct engagement with the public, being part of the community, by:
  - Providing space for local people to mingle with researchers and discuss problems, challenges, ideas for research
  - Provide space for researchers to explain and show their research to local people
  - Hosting community events
  - Being a venue for arts events
  - Being able to represent particular environments for public processes, e.g. for planning inquiries
PEARL commitments

- PEARL is committed to supply the people-environment research capability for UKCRIC over the next 10 years and beyond.

- This means providing original research in PEARL and collaborative research with the other UKCRIC members in order to ensure that infrastructure and cities will be developed to take account of and support the people who will have to use and/or live with such investment.

- PEARL is also committed to supporting the NHS/PHE Healthy New Towns Demonstrators, directly in the case of Barking Riverside, but also acting as a lynch pin for the other nine sites.

- PEARL is included in a number of long-term research projects in the area of person-environment interaction, including clinical, engineering, architecture, design, transport, social and cultural issues related to cities.
Translating PEARL to industry

- The idea is to encourage the translation of the research directly into new enterprises with the support that will enable them to put the research into practice with clients from around the world.

- We know that to convince clients to adopt such proposals, these ideas might need to be demonstrated in practice rather than just be proposed on paper.

- So PEARL needs to foster talent in the person-environment design space to enable its work to be promoted in practice.

- PEARL includes a number of incubator spaces for start-ups and innovative enterprises working in people-environment design.

- These incubator spaces will be rented to the enterprises, together with an agreed access to the PEARL facility to encourage:
  - Active design and composition development by the enterprises,
  - The ability of the enterprises to display and demonstrate their designs to clients.

- We know that to convince clients to adopt such proposals, these ideas might need to be demonstrated in practice rather than just be proposed on paper.

- So PEARL needs to foster talent in the person-environment design space to enable its work to be promoted in practice.
PEARL’s longer term relevance

- PEARL is a commitment for at least 10 years through the UKCRIC programme, which will transform the UK’s approach to infrastructure and city development, with two major outputs to support paradigm change in infrastructure and city design and engineering for all.

- PEARL will lead the way forward in new technologies, techniques, education and public engagement for cities all over the world.

- PEARL stimulates researchers in other fields to consider people-environment interactions – thus is changing other research paradigms across the university.

- The PEARL team is actively involved in changing the way in which cities are planned all over the world, planners, architects and engineers are educated, assisting local communities to contribute actively to their urban environment.

- Current involvements beyond UCL are:
  - London, Southampton, Birmingham, Lancaster
  - Peru, Colombia, Panama, Cuba, Argentina, Chile
  - Japan, China
  - Australia, New Zealand
  - Singapore
  - USA
PEARL outputs

- PEARL researchers and collaborators will publish scientific papers and articles in the most appropriate journals.

- PEARL will have a strong presence in the international conference scene on sustainable urban design and planning, environmental interventions for health and transport system design.

- PEARL will also develop multimedia outputs, through public engagement, books, film, plays, music and opera to convey the message that creating a better quality of life needs better understanding of people-environment interactions.
PEARL outputs strategy

- Given the wide range of PEARL activities and the core PEARL vision of **creating a world where everyone can achieve a better quality of life**, we have a strategy for dissemination that follows two themes:
  - **Community-centred Living**: how understanding and designing for person-environment interactions enables people to develop
  - **Cities for a Higher Quality of Life**: how the design of person-environment interactions lead to a city or community which can foster a better quality of life for everyone
PEARL as a conference facility

The seating system for PEARL is a flexible raked set of units adding up to a total of 600-seats.

This means it can be set up for exciting conferences, workshops and CPD activities.

We don’t want to accommodate a ‘normal’ **conference, workshop or CPD course** though. This is really for a new kind of activity where the central theme is on showing rather than telling. Learning about new ideas and seeing them in action, trying them out for yourselves or learning how to recreate them changes the dynamic of knowledge transfer into a really practical event.

Using the facility as the centrepiece, a conference could use all the various setup alternatives to create a demonstration facility, so that presentations can be brought to real-life and discussed with participants.

There is a catering facility on site and a hotel is being built a few minutes’ walk away.

This might not be in Central London, but then nowhere else would permit you to have a conference in a variety of places all under one roof!
Community-centred living

- Combining the arts, social sciences, anthropology, architecture, engineering, population health, neurology, sensorial sciences, philosophy, economics, geography, etc. to create a way of designing places for the people who will live in and use them, looking in particular how attention paid to small details in the urban environment can have a great impact on people’s quality of life.

- This will be a multimodal expression of scientific output to create great social outcomes, based on the PEARL-based research and summarised in a series of different dissemination models, aiming at different audiences, to be a guide to people to think about how they can change their local environment.
Cities for a higher quality of life

- Following from the first output, this will extend the concepts developed for local places to the life of a city, incorporating all its diversity and differences in aspiration.

- As with the previous output, this will be disseminated in the most appropriate ways possible, including plays, operas, film, games, public engagement events, books, papers, talks, the aim being to ensure that people across the community, from academics to schoolchildren, politicians, to citizens, can understand how they can play a part in making their cities work better for society.
Change the world – for the better!

2016 2018 2020 2022 2024 2026 2028 2030 2032 2034

Building works

Construction starts
Building ready
PEARL in operation

1st PEARL International Biennial Conference

Recommendation for Composition of Places for Community-centred living

Guidance for Composition of Cities for high quality of life

Community engagement

Appointment of new academic staff

Completion of BR HNT
PEARL
Person-Environment-Activity Research Laboratory
Design for the future