

**INSTITUTE OF  
HEALTHCARE ENGINEERING**



**UCL**



**TOMORROW'S HOME 2050  
VISIONS OF HOME-BASED HEALTHCARE  
FINAL REPORT**

# INTRODUCTION

Tomorrow's Home was an immersive exhibition housed at the Museum of the Home in Hoxton between November 2021 and January 2022. Drawing upon leading research from the UCL Institute of Healthcare Engineering, Tomorrow's Home playfully imagined how our dwellings could look in 30 years' time.

Can our houses help us live independently and well as we age, and support our changing planet?

## THE FOUNDATIONS

Tomorrow's Home was born from a generous Ingenious Public Grant from the Royal Academy of Engineering. The remit of this scheme is to support projects that:

-  Inspire creative public engagement with engineering projects
-  Motivate engineers to share their stories, passion and expertise with wider audiences and develop their communication and engagement skills
-  Raise awareness of the diversity, nature and impact of engineering among people of all ages and backgrounds
-  Provide opportunities for engineers to engage with members of the public from groups currently underrepresented in engineering

## THE CONSTRUCTION

The IHE teamed up with visual immersive engagement specialists, The Liminal Space, who use art and design to create unique experiences. The vision was to create tangible elements of the future home, allowing our engineers to experience and examine the potential impact of their work, and have a dialogue with the public. The outcome would be an exciting, immersive pop-up installation where Londoners could experience the future.

This was achieved through a focused, iterative design and development process. Over the course of the project, the IHE and The Liminal Space held focus sessions with engineers and representatives of the public to carve out the desired design and impact.

With the project set to start in 2020, the COVID-19 pandemic threw a spanner in the works. Plans for Tomorrow's Home had to shift and adapt, but the exhibition found its perfect setting in The Museum of the Home, Hoxton – a museum dedicated to exploring what our homes mean to us.

The impact of the pandemic and spending so much time indoors also meant that our collective relationship with our homes and the concept of 'home' changed.

**Home meant many contradictory things depending on who you asked – a place of confinement, security, comfort, and boredom. This influenced the final face of Tomorrow's Home.**



Visitor images Mike Massaro  
Exhibition design The Liminal Space

# TOMORROW'S HOME EXHIBITION

**Tomorrow's Home launched to the public on 22 November 2020 – a multisensory, immersive experience where visitors were invited to cross the threshold to the future.**

The exhibition focused on three main topics which already affect our way of living, but will increasingly come to the fore over the next 30 years:

- Climate change
- An ageing population
- Digital automation

These themes were explored through a collection of storytelling and imaginary household objects and services, from smart-sensor cups that can detect your medication levels, to an AI platform that allows you to interact with deceased loved ones. These interactive items were designed to provoke visitors to reflect on their personal boundaries when it comes to technology.

We encountered these objects as we followed the daily routines of three different inhabitants living in a multigenerational co-habitation:

- Kai, 17, who works for a 3D printing company and has never tasted meat
- Mo, 76, a retired teacher with dementia
- Charlie, 34, with cerebral palsy, who works for a protein manufacturer in Buenos Aires

Visitors witness the ways technology is embedded in these characters' lives – how it supports them to live healthier, more independent lives but also ways it could cross the line from convenient to creepy.

Questions raised during the exhibition:

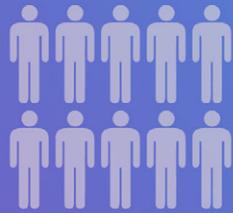
- Would you prefer to snack on perfectly optimised 'smart' food or host healthy microbes on your wallpaper?
- What if your toilet could detect early health problems, but also tell your partner you were having an affair?
- Would you offer living space to a climate change refugee?
- And with smart sensors installed across the home, how will you ever disconnect?

*"The exhibition highlights both the benefits of emerging technology as well as raising important ethical questions: What belongs inside our homes and what do we want to leave at the door? We have used imaginative design and speculative storytelling to bring these complexities to life and encourage audiences to think more deeply about what matters to them in the home of the future".*

*- Sarah Douglas, (Director of the Liminal Space)*

**By posing these provocative questions, the hope was to engage new perspectives into current research and technology development.**

# TOMORROW'S HOME EXHIBITION AT A GLANCE



3000+ VISITORS

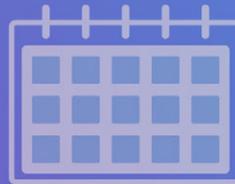


680 EVENT ATTENDEES



44 RESEARCHERS UCL / EXTERNAL

TRAVELED DISTANCES  
average: 11 km  
range: 125 km



8 WEEKS



10 PUBLIC WEBINARS

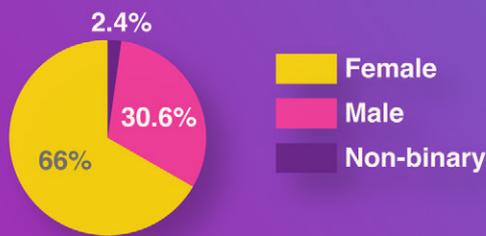


2 IN PERSON WORKSHOPS



MUSEUM OF THE HOME  
Hackney, London

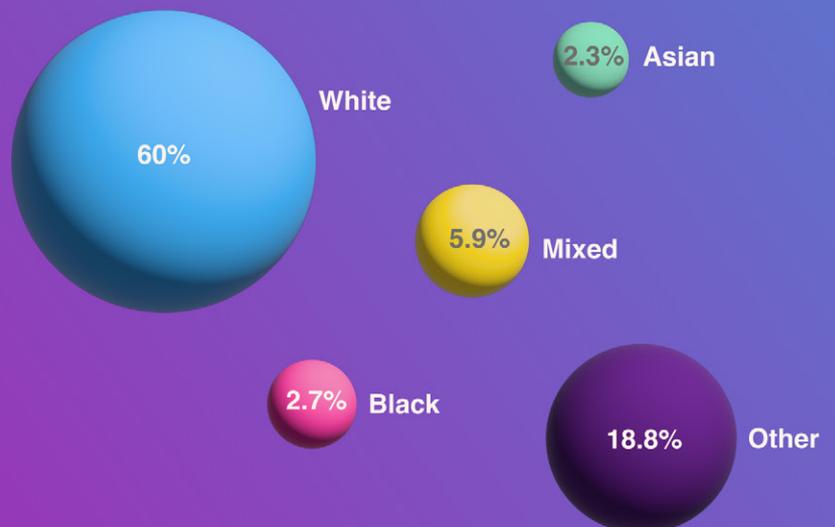
## GENDER OF VISITORS



## 5% OF VISITORS REPORTED A DISABILITY



## ETHNICITY OF VISITORS



## AGE OF VISITORS



# PUBLIC ENGAGEMENT



Alongside the exhibition, we hosted an exciting programme of workshops and drop-in activities.

## WEBINARS

Each week (except over the Christmas period), we held webinar sessions around the key themes of the exhibition. We hosted over 40 speakers from across UCL and beyond.

### Week 1: Connectivity

Smart devices - sometimes referred to as 'the internet of things' - are ubiquitous in our modern homes. From speakers to doorbells and fridges, our home objects are connected to the internet, communicating with each other, and sharing data. Creepy or convenient?

### Week 2: Community

"Everybody needs good neighbours" Or so the classic theme song goes. But could good neighbours (and neighbourhoods) be good for our health? And is it fair that our healthcare and wellbeing outcomes are determined by a so-called 'postcode lottery'?

Our expert speakers discussed how housing, communities and social environments impact our health, and always we can build better futures.



### Week 3: Adaptability

All living species have evolved to adapt to their habitat. But what if our habitats could adapt to suit us? Imagine a home that anticipates your every need and whim. From playing the optimal song to get you out of bed in the morning, to dimming the lights when it senses a romantic moment.

And speaking of adaption, how do we adapt to our changing bodies and identities as we grow older? What role do our physical capabilities and even the sound of our voices play in how we see ourselves?

### Week 4: Sustainability

Building future hopes out of sustainably farmed plant-based materials can give delightful homes with healthy indoor environments that can contribute to a more sustainable environment in several ways. For example, plants absorb atmospheric carbon when they grow and so using plant-based materials can contribute to reducing atmospheric carbon by storing it in building components.

Oliver Wilton and Matthew Barnett Howland from UCL BERN (Building Envelopes Research Network) explained these issues and talked about their recent work with plant-based materials, including Cork House, the world's first structural cork home, which has been recognised as a sustainability exemplar.

### Week 5: Responsibility

From inclusive design to tackling homelessness, what do designers and engineers owe future generations?

## WORKSHOPS

**Our in-person workshops at the Museum of the Home were an opportunity for the UCL community and members of the public to come together and learn from each other.**

### ***'Re-imagining tomorrow's home when I'm older'***

Can our homes provide better health, care and wellbeing? Should they feature high tech, or no tech? What about the use of more data?

And how should our homes best connect us to what matters most, like family, community, our work and social lives, and a flourishing planet?

In this collaborative, interactive and fun workshop, researchers from UCL, Imperial College and the University of Sussex shared their work, and heard important feedback from members of the community about what our future homes should look like.

### ***'Voice and ageing, voice and home'***

Through singing, creative writing and discussion we discovered how our vocal identity is formed both inside and outside the home and how it changes as we get older.

Some of the questions we explored through singing and writing were:

- Do I look older than I sound? Do I sound younger than I feel?
- Do I recognise myself in my voice?
- What is the role of voice in our homes today and in the future?

This event was facilitated by SoundVoice, a team of professional artists who translate research and narratives into imaginative works of art.

## ENGAGEMENT EVALUATION

To help us evaluate how the participating engineers and visitors engaged with Tomorrow's Home exhibition and events, we asked people to fill out questionnaires that were anonymous and on a voluntary basis. Different questionnaires were used for visitor and engineer engagement, to tailor them to the specific insights we wished to gain from the different groups.

Ten of the participating engineers filled out a pre-project questionnaire, designed by the Royal Academy of Engineering. Based on this questionnaire, we created a post-project questionnaire to assess any changes based on their participation in the project.

The questionnaire was a mix of closed and open-ended questions that allowed our engineers to provide qualitative responses about their public engagement experience.

We also asked three early careers researchers who helped facilitate a workshop to reflect and write a blog on their experiences of engaging with the public through an interactive workshop on 'Voice and Ageing' at Tomorrow's Home exhibition.

**"I learned that it is really important to be in touch with the public and to ultimately see how your inventions might be used".**

**- Female 36-65, Computing and Communication**

# TOMORROW'S HOME EXHIBITION PUBLIC ENGAGEMENT

75%

Reported having an increased understanding how to creatively translate academic work into engaging content for general public

## ENGINEERS

78%

Reported feeling quite/very confident when talking to the general public about their work after taking part

88%

Reported an increased understanding of public attitudes towards engineers & engineering

## VISITORS

30%

Reported feeling apprehensive about living in Tomorrow's Home

100%

Reported that Tomorrow's Home was enjoyable and well-organised

42%

Reported feeling worried about devices in their home collecting information about them and their health at all times

58%

Strongly/very strongly agreed that Tomorrow's Home was relevant to them

63%

Strongly/very strongly agreed they had learned something new

# THEMATIC ANALYSIS

Visitors filled out questionnaires designed by UCL IHE and The Liminal Space, in which they responded to the innovation ideas that were envisioned in the Tomorrow's Home exhibition. They also gave feedback on how they would like healthcare engineers and scientists to engage with the general public.

We used this information to explore potential future research themes around the concepts of Connectivity, Sustainability, Adaptability, Data Security, and Responsibility.

Of the innovation ideas that were presented in Tomorrow's Home, those that focused on enhancing personal wellbeing and community cohesion were received most positively by visitors. Smart devices that used personal data for tracking or controversial purposes drew more mixed reactions from visitors, reflected in similar percentages of negative and positive responses.

The way that visitors responded to the collection of personal data by smart devices also appeared to be connected to how their functionality was described, with terms such as 'monitor' and 'analyses' triggering more negative responses than descriptions such as 'respond to' and 'enhance'.

Total number of respondents: 276

- Very strong positive response
- Strong positive response
- Neutral response
- Strong negative response
- Very strong negative response

%



Intelligent toilet that analyses stool and urine samples

%



Personalised smart care device - connected to a team of remote health care workers

%



Community wardrobe - a local shared collection of items for all to use

%



Smart foods tailored to your individual nutritional requirements

%



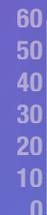
Adaptable wall screens that respond to and enhance your mood

%



Community micro farm providing fresh fruit and vegetables

%



RE-VIVA online service allowing you to interact with friends or family who passed away

%



Therapeutic bed that feeds data back to healthcare companies

%



Indoor wall that enhances the health of your microbiome

%



Indoor wall that enhances the health of your microbiome

%



Sensor-embedded mugs that monitor your health

***‘How should healthcare engineers and scientists collaborate with you and the rest of the public, to design homes that will support us all in the future?’***

The theme that came up the most in visitors’ responses, was that they would like more engagement opportunities, such as Tomorrow’s Home.

Closely related to the theme of engagement, was people’s desire for consultation and co-operation on novel developments and having the opportunity to test out new technology/designs in their homes.

Innovations that are developed around people’s actual needs was another prevalent theme, as was sustainability. Data collection and privacy was another concern that was brought up frequently.

Taking the needs of a broad range of people and communities into account was also brought up regularly.

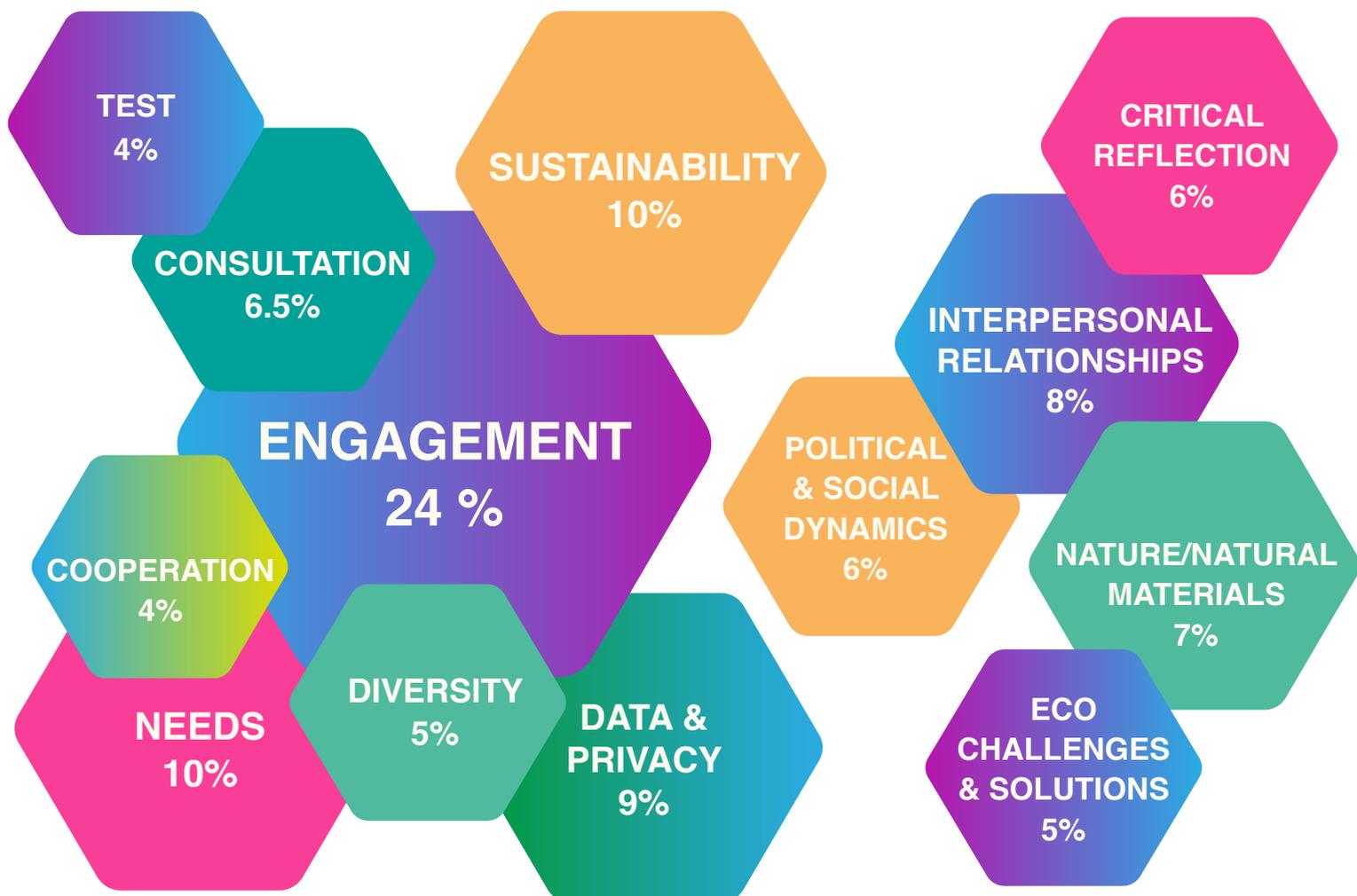
***‘What was missing? What innovations and engineering could exist to support you in the future at home?’***

A theme that came up regularly in visitors’ responses was how (inter-)personal relationships could be nurtured in the future, especially if we’re going to spend more and more time at home.

There were visitors who would have also liked to see more innovation ideas around the use of nature and natural materials.

Some visitors would have liked to see a critical reflection on the implications of these new developments and the use of personal data, also considering the political and social dynamics of innovation.

More information on environmental challenges and possible solutions, in relation to the home and everyday life, were also themes that visitors would like to see addressed .



# PROJECT REFLECTIONS

## PARTNERSHIPS AND COLLABORATIONS

The main partners on the Tomorrow's Home project were The Liminal Space and the Museum of the Home. We all mutually benefitted from being project partners in terms of pulling together our resources and creating a critical mass of multidisciplinary expertise from the academic, museum and artistic design sector. The exhibition gained much publicity for all three partners, with London Live TV filming our academics in the museum, as well as The Observer Magazine writing a frontpage article about the exhibition and its themes.

## PROJECT EVALUATION

*Marilyn Aviles, Project Lead:*

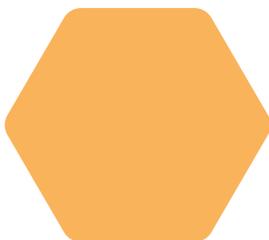
This was a complex project, delivered over a period of challenging times during the pandemic, involving a multidisciplinary collection of stakeholders. One of our most successful elements was maintaining a good working relationship with our project partners and managing to deliver a programme of work (the exhibition and a series of multidisciplinary events) that showcased healthcare engineering research in a reflective setting. This gave rise to interesting discussions and reflections with both academics/engineers and members of the public about the role of science, technology, and engineering in creating a better, and healthier future for communities.

## The impact of COVID-19

Firstly, delivery of the project must be understood within the broader context of the pandemic. We lost time during the early stages as we navigated the uncertainty of whether project delivery, workshops and training activities that should be done in person, could be done online. We adapted as a group and the additional time, funding and understanding from the Royal Academy of Engineering was pivotal in our successful delivery.

## Maximising the budget and leveraging our community connections

Our starting budget was small relative to our overall vision, yet we were able to deliver a substantial programme of work beyond our original plans because of the level of in-kind support we received from The Museum of the Home and UCL academics. We also obtained additional funding from UCL Grand Challenges and the UCL WEISS Centre.



Eliciting enthusiasm for the vision and themes of the project across a wide variety of stakeholders was key to the success of the project. One of our plans to increase our overall project budget was to get engagement from industry partners. We attempted to do so, without much success. We think this is due to the pandemic and the overall uncertainties in the economies of the sector at the time.

We would have liked to have more engagement with local school children, we knew some visited the exhibition, and on hindsight, we could have engaged with schools prior to the exhibition opening and set some activities using the exhibition as a learning setting. Again, the pandemic was a real barrier here given schools themselves were struggling with the lack of 'normality' in their routine. Our evaluation activities needed more resources.

We formed a small working group and received very helpful advice from Ben Gammon from The Royal Academy of Engineering, however in hindsight, our plans could have been more focused and could have done with a larger group to aid in planning and delivery. We had plans for the evaluation at the very start of the project, however in practice, we ended up developing and implementing these much later than intended.

### Reaching under-served audiences

We did not have targeted activities with underserved audiences. Our original plan was to deliver a pop-up version of the exhibition that could travel and target underserved communities. With the uncertainties surrounding the pandemic, it was difficult to plan for this. However, with our limited postcode data, we do know we reached a population coming from deprived local communities in Hackney, which rank among the 10-30% most deprived neighbourhoods in the country (Source: Index of Multiple Deprivation (IMD) 2019).



“When talking to people through the exhibition, I learnt that often the public wants to talk to you but doesn't really want you to monologue about the work.”

- Male, 22-35, Biomedical Engineering



“I'm so glad I visited; it has given me insight into how things can help us in the future for a better world”.

- Asian female, 55-65



*Alice Hardy, IHE Content & Marketing Manager, on the event series:*

As we were planning the events, and the exhibition, we were very conscious that we were/are still living in a time where COVID is a concern for many people. We were especially conscious of this given the focus on healthy ageing and living well – our worst nightmare was that an in-person event would become a super spreader event, affecting vulnerable people.

How could we responsibly combine face-to-face opportunities for those who wanted them, with virtual opportunities for those who couldn't or preferred not to attend in-person? I think we achieved a fairly good balance, but I would say by late 2021, people were feeling the webinar fatigue and craving in-person contact. The energy in the physical events was uplifting.

With Tomorrow's Home, we really wanted to celebrate the amazing work of our researchers – who are developing life-changing technologies – and so a physical exhibition after so long without face-to-face contact with their peers was a wonderful opportunity.

Then the omicron variant hit, and people once again reverted to more cautious behaviours – we cancelled our later in-person sessions, which was a shame, but the right thing to do. The museum was also forced to briefly close as a result of staff shortages.

In terms of the numbers of events in the timescale, this was our most ambitious events series ever! Ensuring there were ample in-person events and ample virtual events, meant the schedule got very busy! We had more than 40 speakers, 600 registrations, 8 online events, 6 in-person events. It was great to engage with such a range of speakers and we've had new opportunities come out of that.



# PROJECT TEAM

## UCL



**Rebecca Shipley**  
 Professor of Healthcare Engineering  
 Director of the UCL Institute of  
 Healthcare Engineering



**Marilyn Aviles**  
 Project Lead  
 UCL Institute of Healthcare Engineering



**Daniel Taylor**  
 Public Engagement Coordinator  
 Wellcome / EPSRC Centre for  
 Interventional and Surgical Sciences



**Mine Orlu**  
 Associate Professor  
 UCL School of Pharmacy



**Marianna Obrist**  
 Professor of Multisensory Interfaces  
 UCL Interaction Centre



**Ben Littlefield**  
 Public Engagement  
 Manager (BEAMS) - UCL



**Emma Bryant**  
 Museum Educator  
 UCL Senior Schools  
 Engagement Officer



**Georgie Cade**  
 Communications  
 and Impact Manager  
 UCL Institute of Healthcare  
 Engineering

## MUSEUM OF THE HOME



**Vanessa Meade**  
 Curator: Exhibitions and  
 Interpretation



**Alice Hardy**  
 Content Marketing Manager  
 UCL Institute of Healthcare  
 Engineering

## THE LIMINAL SPACE

### COMMUNITY GROUPS



**Sharon Gordon**  
 Director  
 (formerly) West Euston  
 Partnership



**Sarah Douglas**  
 Director



**Ann Brolan**  
 Wellbeing Development  
 (formerly) Anchor  
 Hanover



**Rachael Harris**  
 Project Manager

# FUTURE DIRECTIONS

**Although our installation at the Museum of the Home has come to an end, that doesn't mean Tomorrow's Home is over. The legacy of Tomorrow's Home expands far beyond the physical exhibition. The project sparked several discussions and collaborations around its key topics.**

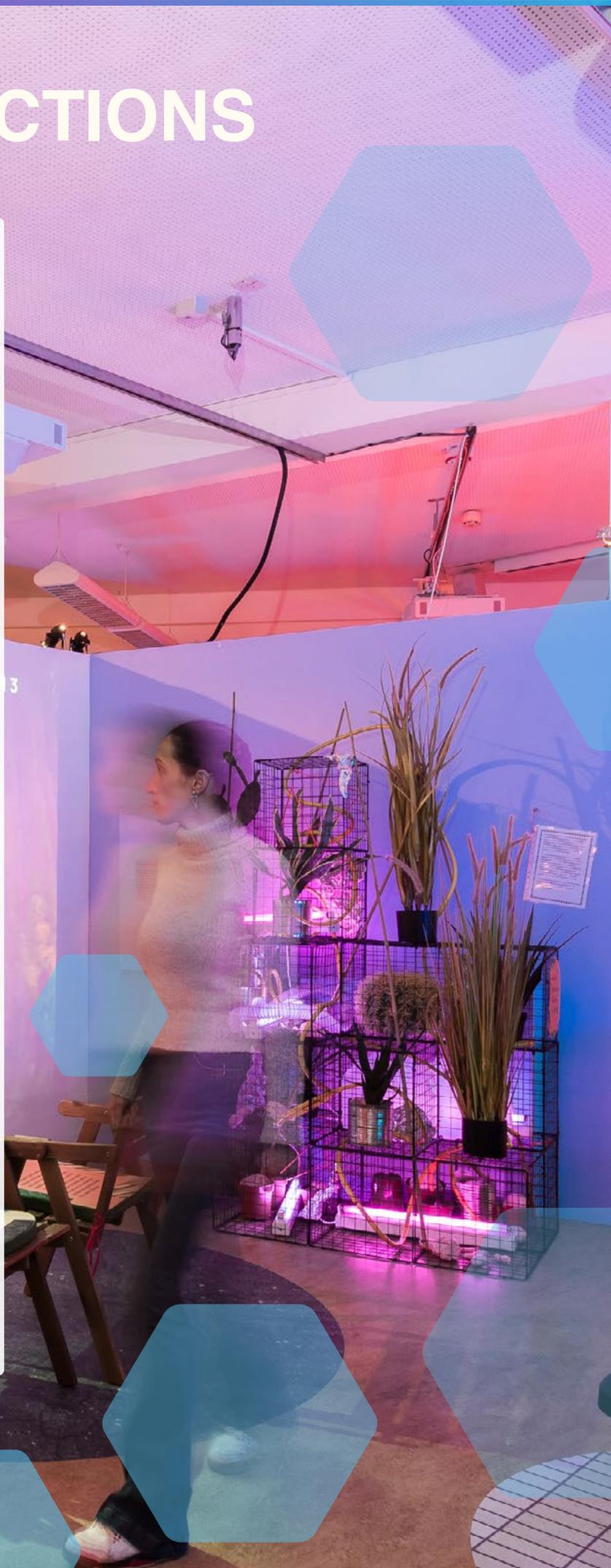
There are three projects that are exploring Tomorrow's Home as a thematic area for discussion around research activities.

One potential collaboration that is being explored is with an institute (IIT-Madras) in India as part of a joint activity between IHE and UCL's Global Engagement Office.

Another is Cian O'Donovan's 'Unpacking Project', a collaboration with The Liminal Space and co-funded by IHE. This project explores how digital infrastructures and identity-making contribute to independence and healthy ageing, and maybe how that shifts over time along patient/resident pathways.

And finally, Monica Lakhanpaul's 'Champion Project' explores the meaning of home for families and children living in temporary accommodations. This project is a collaboration with Sound Voice and is part-funded by IHE.

We're exploring different options to ensure the longevity of the Tomorrow's Home exhibition and we look forward to updating you on the progress of new developments when we can.



## **FUNDING**

Tomorrow's Home 2050 was made possible by financial support from: The Royal Academy of Engineering, UCL Grand Challenges, and the UCL Weiss Centre. The Museum of the Home provided valuable support in kind.

## **ACKNOWLEDGEMENTS**

Exhibition design: The Liminal Space

Exhibition and event photography: Mike Massaro

Data visualisation and report design: Janneke van Leeuwen

A special thanks to the participating engineers, the project team, visitors, and everyone else who contributed to the success of this interdisciplinary project.



**HEALTHCARE  
ENGINEERING**

Website: [www.ucl.ac.uk/healthcare-engineering](http://www.ucl.ac.uk/healthcare-engineering)



[healthcare-eng@ucl.ac.uk](mailto:healthcare-eng@ucl.ac.uk)



[@health\\_eng](https://twitter.com/health_eng)