

Research

Horizons

Pioneering research from the University of Cambridge

Issue 38

Special Issue

East of England

Features

Infrastructure
Inequality
Education
Place
Innovation
Environment
Health
Heritage
Skills
Crime
Agri-tech



UNIVERSITY OF
CAMBRIDGE

www.cam.ac.uk/research

Contents

Features

4 – 5 Place

6 – 9 Infrastructure

10 – 11 Inequality

12 – 13 Coastal erosion

14 – 17 Education

18 – 19 Innovation

20 – 21 Environment

22 – 25 Healthy ageing

26 – 27 Heritage

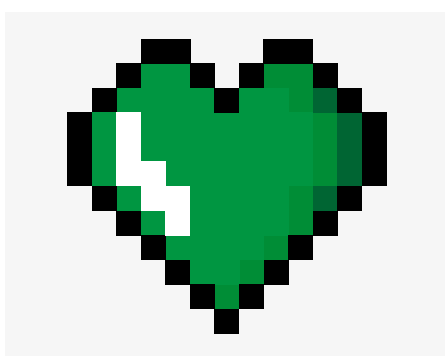
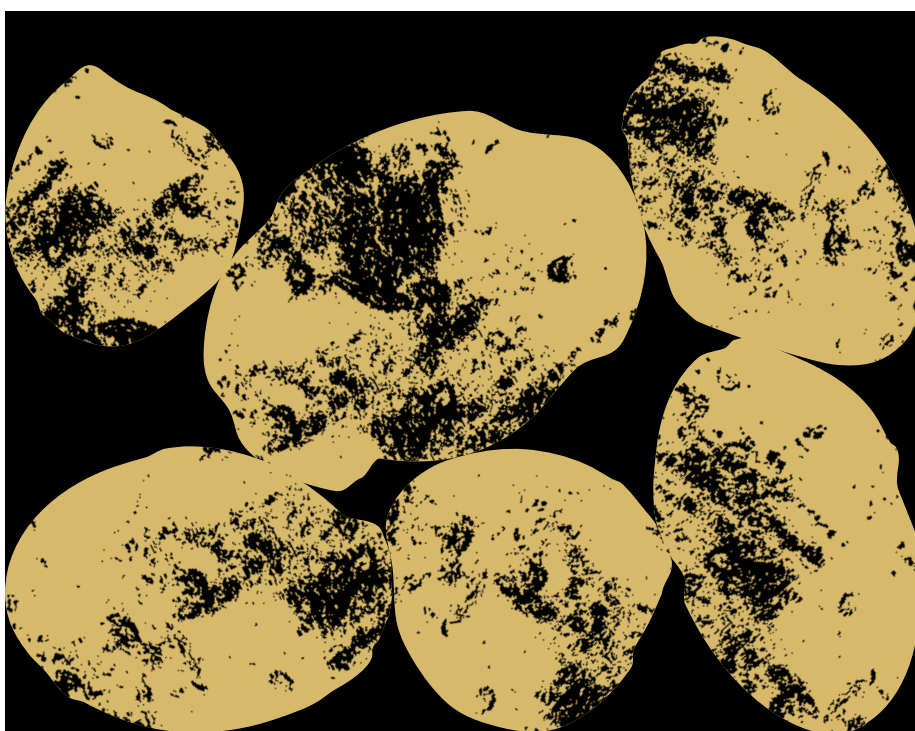
28 – 29 Skills

30 – 31 Crime

32 – 35 Agri-tech

36 – 37 Health services

38 – 39 Pre-school skills



Welcome



The University of Cambridge is a global institution. Our students and staff come from all over the world; our researchers conduct their work on every continent. Notwithstanding this international outlook and impact, our University is firmly and proudly planted in the East of England. Our roots in the region run deep because of our longevity.

In fulfilling our mission – to contribute to society through the pursuit of education, learning and research – we are fundamentally committed to engaging with communities and partners close to home.

This issue of *Research Horizons* features a selection of the research and outreach activities carried out by Cambridge academics across the East of England, an area that includes the counties of Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk.

The region has many assets – innovative and entrepreneurial people, hugely successful clusters of knowledge-intensive industries, vast tracts of high-quality agricultural land and outstanding academic institutions.

But the region also faces multiple challenges. In some areas, acute economic inequalities are linked to low educational outcomes, poor health, skills deficits and reduced connectivity.

At the University of Cambridge, we take seriously our responsibility to be a champion for the region and to help address some of its more pressing challenges. In collaboration with local partners, researchers are offering innovative approaches to areas ranging from understanding coastal erosion to ensuring healthy ageing and from tackling inequality to enhancing agriculture.

Whether it is helping to improve skills and education, supporting innovation and better infrastructure, bringing an evidence-based approach to criminal justice or assisting the management of national heritage, Cambridge research is having a real impact on some of the biggest problems facing the UK today.

Collaboration allows our researchers to draw on, and learn from, our partners' expertise, while amplifying the impact and reach of our own knowledge. Lessons learned locally are transferable far beyond the eastern counties.

This is a good time to share these stories of local engagement. Some have direct relevance to the government's Industrial Strategy, which aims "to boost productivity... to create good jobs and increase the earning power of people throughout the UK with investment in skills, industries and infrastructure." Many of the themes covered in this issue reflect that aspiration.

I hope this special issue will achieve two things. First, that it will be of value to policymakers – in the eastern region and beyond – who are grappling with the local issues we explore. Second, that it will demonstrate the many intricate ways in which a global institution like ours discharges its duty to serve and support local communities.

The University of Cambridge must be a good local citizen, an advocate for the region, a national asset and a truly global actor. Balancing these distinct roles is not easy. Beyond the expertise we bring to our partnerships, it requires openness, and the humility to listen and learn what our communities expect from us. This is the only way an institution such as ours can offer the greatest and widest possible value to society, at home and abroad.

In the region, as elsewhere, there is always more to do. But the breadth and longevity of our mutually beneficial partnerships with local authorities and policymakers, schools, healthcare providers, businesses, employers and research institutions underscore the importance that these relationships have for us.

Our engagement takes many shapes and serves many purposes. Our academic community remains open to new and creative forms of working with partners in the East of England.

We hope you enjoy this edition of *Research Horizons*.

Professor Stephen Toope
Vice-Chancellor

Editor
Dr Louise Walsh

Associate editors
Aaron Cohen-Gold and Fred Lewsey

Editorial advisors
Professor Phil Allmendinger, Dr Mia Gray,
Professor Mike Kenny and Professor Andy Neely

Design
The District

T +44 (0)1223 765 443
E research.horizons@admin.cam.ac.uk
W cam.ac.uk/research

Copyright ©2019 University of Cambridge and Contributors as identified. The content of *Research Horizons*, with the exception of images and illustrations, is made available for non-commercial re-use in another work under the terms of the Creative Commons Attribution-Non-Commercial-ShareAlike Licence (<http://creativecommons.org/licenses/by-nc-sa/3.0/>), subject to acknowledgement of the original author/s, the title of the individual work and the University of Cambridge. This Licence requires any new work with an adaptation of content to be distributed and re-licensed under the same licence terms. *Research Horizons* is produced by the University of Cambridge's Office of External Affairs and Communications.



What account should policymaking take of the notion of ‘place’ – the landscapes, cities and towns we inhabit, with all the opportunities and challenges they bring?

Place matters for policymakers

Ben Goodair and Michael Kenny, from Cambridge’s newly established Bennett Institute for Public Policy, explore the question of place in light of the different responses to the EU Referendum in the eastern region.

The EU Referendum of June 2016 shone a light upon some of the deep fault lines contained within British society, throwing up profound and uncomfortable questions about what underpinned the differences in people’s perspectives that were revealed in the vote. Evidence

suggests that you were much more likely to have voted to Leave if you had not been to university, were over the age of 45 and lived in a town or the countryside rather than a city.

This seismic event, along with the other political earthquakes currently shaking democratic politics throughout the Western world, reveals societies that are profoundly divergent in terms of political values and cultural outlook. Life chances are often contingent on where you are born, where you grow up and what access you have to educational opportunity. ‘Place’, in other words, has a

profound influence on our sense of where we belong and the values we prefer.

For politicians and policymakers who came of age during years of sustained economic growth, and who assumed the financially driven economy would generate opportunities for all, these deeply structural patterns of inequality must come as a shock. Anger and frustration underpinned the revolts by the disenchanted against democracy's political establishments, sentiments which powered new waves of popular protest and support for populist challenger parties.

These responses highlight the inadequacies of a policy paradigm rooted in assumptions about stable economic growth, the unalloyed merits of urban expansion, and the capacity and political will of states to redistribute public goods across poorer regions.

Government is not alone in bearing responsibility for these issues. Academic experts could also have done more to highlight the major inequalities that are opening up across our democratic lives. These inequalities have helped fuel the very different responses to Brexit that have been apparent in our own 'place'.

The city of Cambridge was very clearly in favour of Remain in the Referendum – with 73.8% voting in favour. But drive for 30 minutes in almost any direction from the centre and you will find yourself in villages or towns that voted overwhelmingly for Leave. They may be geographically close, but, in relation to Brexit, a chasm of outlook and experience divides Cambridge from the places around it.

A new Combined Authority now links Cambridge, Cambridgeshire and Peterborough – one of a number of innovations in administrative devolution introduced in England in recent years. This single jurisdiction has a limited set of powers conferred upon its elected Mayor. These new arrangements have had the effect of formally linking Cambridge and its world-class university to districts and towns from which it is, in many ways, a world away. This has created a kind of natural experiment on our doorstep, a smaller-scale replica of some of the geographical divides that are apparent across the country. Some of the social inequalities that exist in the eastern region are ingrained – and are one reason why this area lacks a sense of shared geographical identity. Divides of this sort will require both political will and policy ingenuity to solve.

If we compare Cambridge and Peterborough, for instance, the latter's inhabitants have a significantly lower standard of living, on average, than their counterparts in Cambridge. On a range of public health measures, from obesity

to physical activity levels and avoidable mortalities, there is an entrenched difference between these towns. More of Peterborough's children receive free school meals, and a much lower proportion of its residents have access to further and higher education. Most Cambridge full-time residents can expect to earn £120 more per week than their Peterborough equivalent; and the latter's inhabitants can expect, on average, to live two years fewer than their Cambridge counterparts.

There are significant disparities within each of these places, as well as between them. In 2018, for instance, the think tank Centre for Cities ranked Cambridge the most unequal city in the UK – for the second year in a row – which should give us pause for thought. Cambridge is home to an extraordinary concentration of academic expertise, innovation and knowledge-intensive industries. How can the economic and societal benefits of these assets be more evenly distributed?

“Divides of this sort will require both political will and policy ingenuity to solve”

The University has a key role to play in addressing these issues. At Cambridge's newly established Bennett Institute for Public Policy, we are committed to a deeper understanding of them, and to helping policymakers think through different potential responses.

For instance, we are currently examining some of the main differences in economic opportunity and social provision that characterise life in different kinds of town within England, looking at whether the 'footprint' of public services is receding more dramatically in, for instance, post-industrial towns than elsewhere. And we are exploring ways in which the newly created tier of Combined Authorities, including that in Cambridgeshire and Peterborough, can improve in terms of their political accountability to their citizens.

Cambridge is, in relative terms, one of the wealthiest parts of the country. The city is one of the strongest sources of economic growth in the UK, and a provider of employment for many residents from Cambridgeshire – though relatively

In brief	
What	Place, policy, inequality
Where	Cambridgeshire, Fenland, Peterborough
Who	Bennett Institute for Public Policy

few from Fenland or Peterborough. The most widely aired solution to the region's imbalances is to do more to improve its connectivity to the areas that lie beyond its boundaries. To get to the root of the economic disparity in the Cambridgeshire and Peterborough region, we need to understand the underlying factors that make 'place' so important both to the innovation industries that have flourished in Cambridge and to the other kinds of business – notably agriculture – in the landscape that surrounds it.

The University houses a range of individuals and groups with considerable academic expertise on the social and policy issues facing the region, and the importance of place. Several of these have made important contributions to policy debates, for instance as advisors to, and members of, the Cambridgeshire and Peterborough Independent Economic Review, the Greater Cambridge Partnership and the Combined Authority's Business Board.

Understanding the importance of place to public policy does not just mean thinking locally, however. There are many different kinds of community – institutional, cultural, or voluntary – which matter to people, and also to policymakers, and some of these extend beyond national borders while others reside within them. In policy circles, the notion of place is a more recent discovery in the wake of events like Brexit. Our conclusion is that bringing intellectual depth and a richer evidence base to this emergent issue is one of the major contributions which the University can make to public policy in our region.

Ben Goodair is a Research Assistant at the Bennett Institute for Public Policy, and Professor Michael Kenny is its inaugural Director.



Words

Ben Goodair and Michael Kenny

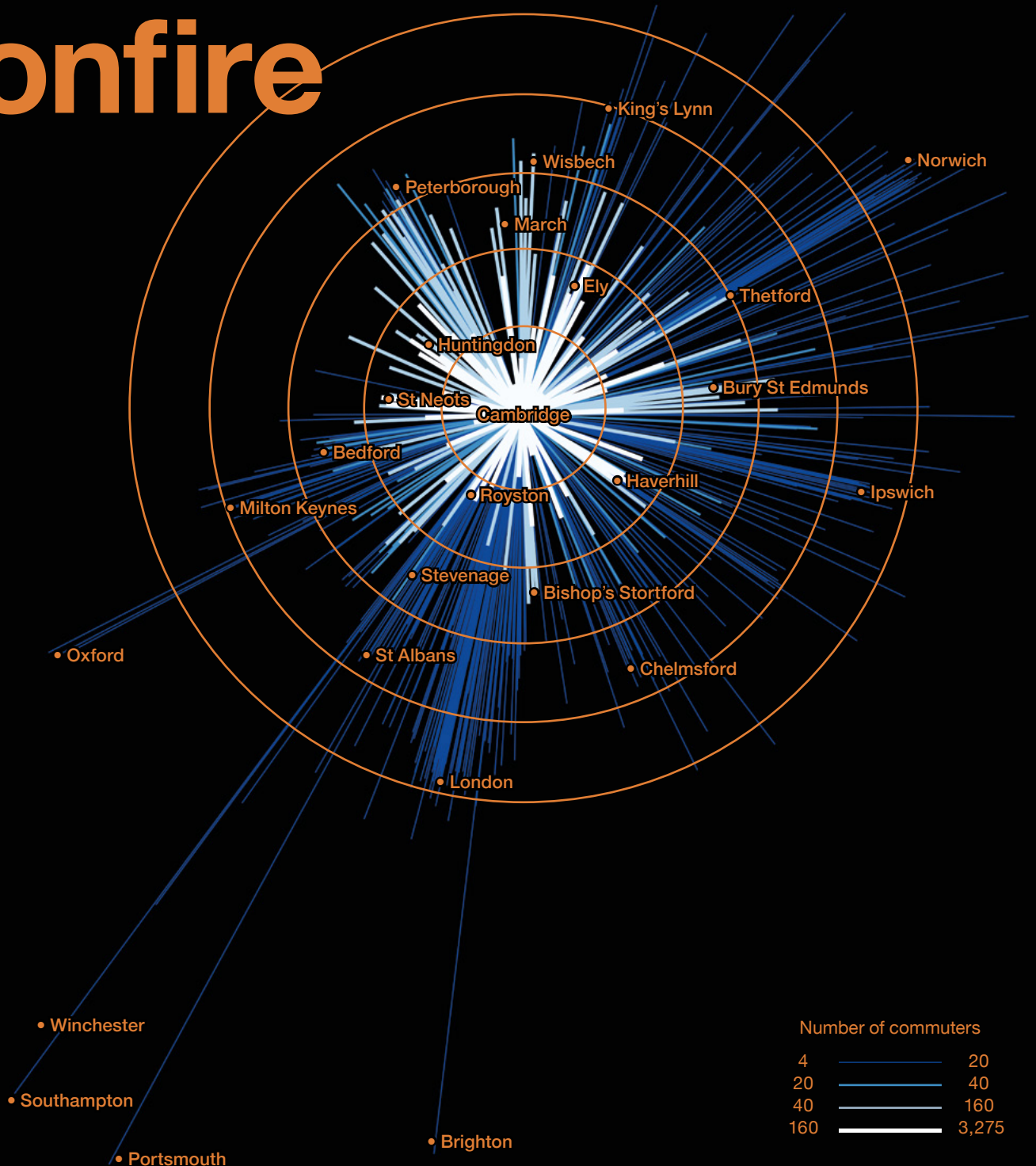
How to tend an economic bonfire



Words
Louise Walsh



Image
Commuting flows to Cambridge



Credit: Lines represent number of commuters travelling from 'Middle Layer Super output Areas' in the Greater South East to Cambridge Local Authority District (source: 2011 Census ©Crown copyright and database rights 2019); mapping: Steven Denman, Dept of Architecture

Business, enterprise and employment are flourishing in Greater Cambridge. But housing and infrastructure are struggling to match the jobs boom, and gaps in social equality keep widening. University academics are connecting their insights, data and algorithms to find solutions to the area's "growing pains".

"Economic growth is like a bonfire," says Matthew Bullock. "You can get a bonfire going and expand it as long as you keep feeding the centre. But you can't pick a bonfire up and move it somewhere else."

Bullock is talking about the economy of Greater Cambridge, where a staggering level of growth has outpaced the rest of UK over the past decade. As one of the founders of the business and academic organisation Cambridge Ahead, Bullock has been helping to shape a vision for Cambridge and the people who live and work in the area.

"Growth here comes up through the floorboards," says Bullock, who was one of the original financiers of the 'Cambridge Phenomenon' – the development and growth in high-tech businesses in and around the city since the late 1970s – and is now Master of St Edmund's College.

"The city has the highest number of patent applications per hundred thousand people compared with any other city in the UK. Innovation, networks, start-ups, collaboration, entrepreneurs – all of these create an energy here that's resulted in discoveries that transform lives around the world, and a wave of expansion in jobs and business clusters locally."

Today, around 60,000 people work in 4,700 knowledge-intensive companies in Greater Cambridge, particularly in computers and software, life sciences, high-tech manufacturing and AI. These companies contribute around a third of global turnover of all companies based in the area. Global companies such as Amazon, Apple, ARM and AstraZeneca have chosen Cambridge to relocate or expand their offices.

But success often comes at a price. The agglomerative benefits that have brought new and innovative businesses towards the economic heat of this 'bonfire' have also brought soaring house prices, social inequality and congested roads. Cambridge city's average house price in 1997 was 4.5 times a median salary; today it is 16 times. And in 2018, the think tank Centre for Cities reported that Cambridge was the least equal city in the UK.

"House prices and rents are becoming unaffordable, pricing people away from the city and into car-dependency," says Bullock. If employment continues to grow at the rate of the past five years, in-commuters would rise by 82%, which

would mean 160,000 commuters coming into Cambridge by 2031. "Our roads couldn't handle this."

Bullock is also part of the leadership team behind the Cambridgeshire & Peterborough Independent Economic Review (CPIER), which for the past year has been examining the region's economy, infrastructure, society – and its future. The team recently reported its findings to the Cambridgeshire and Peterborough Combined Authority – the body responsible for local strategic transport and infrastructure planning.

"If nothing is done," says the CPIER report, "the damage to society from the continuing drift away of less well-paid workers may become irreparable, the ageing of the city will affect its dynamism, and the cost to people's mental health of commuting-induced stress and housing insecurity will soar. Cambridge is at a decisive moment in its history where it must choose whether it wants to once again reshape itself for growth, or let itself stagnate and potentially wither."

The forecasters

Dr Ying Jin, from the Department of Architecture, has led the building of a computer model that helps foresee the effects of future planning options for Greater Cambridge.

The model uses data on buildings, green spaces, housing, jobs, businesses, shops, services, schools, means of transport, congestion on roads, crowding on trains, rents, wages, prices and perceptions of wellbeing.

So rich is the data that no one person could hold it in their brain all at once, which is why Jin has built a computer model to thread all of the information together. The model, 'LUISA', provides 'a lens' to look at future working, living and travelling in and around Greater Cambridge.

With funding from CPIER and Cambridge Ahead, Jin and colleagues have been using LUISA to model alternative trajectories for the region covered by the Cambridgeshire and Peterborough Combined Authority, which includes cities, market towns and Fenland villages with growing connections to Greater Cambridge. The outcomes of the scenarios have become a crucial component of CPIER's recommendations to the Combined Authority.

"LUISA is like a virtual digital lab for people to explore the long-term consequences of decisions made now," explains Jin. "How many houses need building? How will their location in relation to jobs affect transport and congestion? What will this mean for rents, living costs, the economic health of the companies and the wellbeing of its inhabitants?"

In brief	
What	Infrastructure, productivity, place, business, housing, transport, employment
Where	Cambridge, East Cambridgeshire, Fenland, Huntingdonshire, Peterborough, South Cambridgeshire
Who	Cambridgeshire & Peterborough Independent Economic Review, Dept of Architecture, Cambridge Judge Business School, Dept of Land Economy, Dept of Geography

IN-COMMUTERS COULD RISE

82%
BY 2031

This isn't the first time that this type of modelling has been used in Cambridge – Jin's colleagues Professors Peter Carolin and Marcial Echenique pioneered the format with a programme called Cambridge Futures in 1997.

"Peter and Marcial showed that the planning of jobs and housing should be linked to transport, and vice versa. Too often, land is allocated to housing without enough thought about where people work and how they will get there," says Jin. "Cambridge Futures was groundbreaking – it contributed to a new culture of joined-up, collaborative planning in the Greater Cambridge area."

Bullock agrees: "Cambridge Futures led to key proposed developments – such as the West Cambridge site, Eddington and the Cambridge Biomedical Campus. This sent a very big signal that Cambridge was open for growth. The planners made a courageous attempt to be thoroughly up with the game. Even so, the growth that the Cambridge Futures programme predicted was said by some at the time to be 'obscene' in its estimation of the numbers of houses that would be needed. In fact, time has shown that we needed more."

The data makers

What makes LUISA unique is its ability to treat developments in jobs, housing and transport as parts of one integral system – and the fact that it's been tested on over three decades of data and knowledge on business and consumer behaviour.

"Policymakers, business leaders, community activists and academic researchers all aspire to coordinated interventions on jobs, housing and transport," says Jin. "But they are frustrated because data from national sources is often lagging behind reality and in many cases the statistical samples are too thin to tell a reliable story for a local area. The more detailed modelling by LUISA shows a whole picture of how jobs, housing demand and travel connect together, and this helps local communities make sense of what interventions will work well."

LUISA leverages data and knowledge from experts across the University, the local planning and transport data from district and county councils, and advice from local experts on housing, transport, commercial space, digital connectivity and green space.

For instance, Dr Andy Cosh, from the Centre for Business Research at Cambridge Judge Business School, is responsible for the Cambridge Cluster map. This resource is the most accurate reflection of the region's businesses – those that are being born, arriving, merging, thriving, leaving, dying. The diligent process by which he and his team build and

maintain the dataset gives some idea of why LUISA is so powerful.

First, Cosh's team sets an algorithm to trawl annually through the audited records of almost 50k 'live' companies across 14 local authority districts (25k of which are in the Cambridge area) and a further 20k that have died. A business can have a single employee and would still be counted. Then begins the 'clean-up' – categorising companies into sectors, holding 'eyeballing sessions' with business groups to verify the data, checking the accuracy of their location, and then rechecking their files of 'awkward cases'. "We're interested in the energy of the region. The dynamism. For me, failure is a sign of this – if you have birth and death it shows you have a dynamic economy," says Cosh.

"The granularity of our process means we can pick up trends that other data sources haven't been able to. We've found for instance that the employment growth rates are much stronger than indicated by official figures. The economy in Cambridge and South Cambridgeshire continues to roar away."

This isn't just interesting from a local point of view, says Bullock: "After spending a year with CPIER 'getting under the skin' of the region, and considering its role in the future of the UK, our conclusion is that its success is a project of national importance."

Alternative futures for harnessing growth

But how possible is it to forecast the future given the uncertainties the UK faces around politics, the economy, technology, migration, climate change, and so on? LUISA tackles the challenge of future volatilities by separating out what is hard to predict from what is highly predictable, and by examining a wide range of possible scenarios, says Jin.

"The hard to predict includes political votes, large individual investments and breakthroughs of critical technologies such as autonomous driving," says Jin.

"On the other hand, business and consumer choices under a given scenario of jobs, house building and transport are highly predictable by a good computer model. When jobs, house building and transport stay in balance, business productivity and residents' wellbeing rise; when this balance is lost, businesses balk at the rising costs and residents lose out."

To start with, the team used LUISA to examine a 'business as usual' approach, in which the region develops according to current housing and infrastructure plans. The model showed that even a modest rise in jobs – far lower than what Cosh's team is witnessing – would result in considerable rent and wage pressures in Cambridge and South Cambridgeshire, with roads seriously unable to cope with the in-commuting.

"Growth will be choked off," says Jin. "As high wages and prices are fed back to business location choice, businesses will modify their plans and move away, most likely overseas to other knowledge-intensive clusters."

A recent survey of the largest businesses by the Centre for Business Research confirmed that companies would be more likely to move overseas rather than to other parts of the UK, resulting in a loss of jobs and output for the UK.

"It might not happen cataclysmically, it could just slide away, starting as early as 2021," adds Jin. "By 2031, we could see the level of employment and economic growth start to go into reverse."

Crucially, LUISA can also be used to understand what should be done to achieve the full potential of the Cambridge region. For CPIER, LUISA tested four distinct scenarios that might help the city region adapt to a higher level of job growth in its 'bonfire economy' to reap economic, social and environmental benefits.

A 'densification' scenario creates new employment sites and housing without expanding the city's boundaries – in other words building taller, denser or both. 'Fringe growth' creates new urban areas around the edges. In a 'dispersal' scenario, growth happens elsewhere – in market towns or newly created towns away from Greater Cambridge. And in a 'transport corridor' scenario, jobs and housing are developed along 'rapid-transit' services that radiate outwards from Cambridge.

Of course, each of the scenarios has pluses and minuses. Densification posed a risk of increased congestion; expansion at the urban fringes generated high financial returns but at an environmental cost to Green Belt land and a rise in car use; dispersal helped the spread of jobs but only if a large number of companies were willing to move to areas distant from Cambridge, which was unlikely.

Transport corridors came closest to supporting a 'win-win' intervention of continued success in high-growth regions while unlocking the potential of low-growth regions through better transport connections, but it would require a very large new investment in infrastructure.

"The most likely outcome of planning for growth is that it will involve 'mix-and-match' scenarios," says Jin. "The purpose of the four scenarios is to map out the strengths and weaknesses of each. This would help the local authorities and communities to design their own mix-and-match scenarios in a democratic process."

Following the CPIER report, the results from LUISA are now feeding into the district councils' new land use plans and the Combined Authority's local transport

plans, says Jin: “This is where a virtual lab can make an effective contribution. It’s worth the effort because rebalancing jobs, housing and transport is rarely a zero-sum game.”

Local industrial strategy

Bullock and members of CPIER see this as a crucial time for decision-makers.

Bullock is optimistic: “People understand what the issues are now. There’s an easing in the tension about growth in Cambridge and a better understanding of the different economies across the region that the Combined Authority can now shape. In many ways the region is a microcosm of the UK in terms of the challenges faced.”

Professor Pete Tyler, from the Department of Land Economy and who also contributed data to LUISA, agrees: “One of the biggest issues the UK faces is upgrading its infrastructure to improve connectivity. We are seeing the importance of that here, where infrastructure can be a constraining factor to economic growth.”

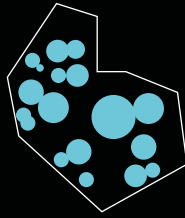
Tyler has been part of a multi-university project called City Evolutions led by Professor Ron Martin in the Department of Geography. The project, funded by the Economic and Social Research Council, produced an in-depth economic analysis of UK cities to see how they have adapted over time.

“If you look at growth in productivity, we observe quite significant differences between cities in how they adjust to economic change,” says Tyler. “Places like Cambridge are among the fastest-growing cities that are suffering the growing pains of a lack of good-quality infrastructure and enough affordable housing to tackle the issue of social inclusivity.”

“It’s impossible to tell a story about city adjustment without thinking about what will happen to the resource base. Local areas have little fiscal capacity and rely on discretionary finance from central government to put in more infrastructure.”

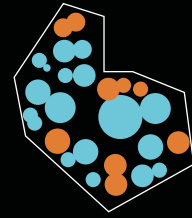
The government has tasked local authorities to deliver local industrial strategies, and this is where Tyler and Bullock believe the ongoing work of CPIER and University researchers can help.

“It’s clear that no single blueprint for future development will work for all areas,” says Bullock. “Formulating a local industrial strategy requires regions to show they have a comprehensive vision for how they can use their resources. LUISA has helped us to know our strengths, our weaknesses and how our distinct economies grow. Used well, the evidence can support developments to improve the quality of life right across this region. And the techniques we have developed here are readily applicable in other regions too.”



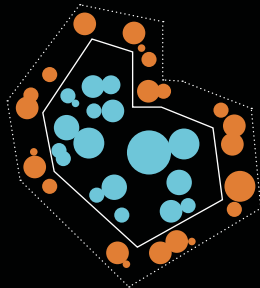
Extrapolation of current trends

This assumes jobs grow in the city and suburban hotspots; housing is built in areas targeted by the local plans, which are often far away from job hot spots. Transport links are upgraded in a way that seems reasonable based on current trends and timelines.



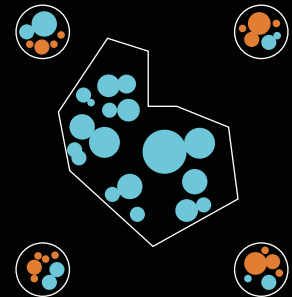
Densification

This approach involves more houses and jobs being created in the Cambridge and Peterborough urban areas without significantly expanding boundaries. Brownfield space is used to create high-density accommodation to increase the number of people who live and work there.



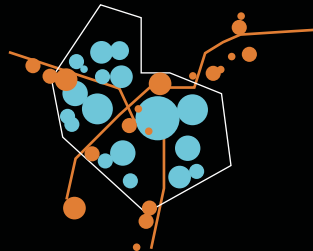
Fringe growth

In the fringe growth scenario, large expansions happen on the outside of Cambridge and Peterborough, while the level of housing density within cities is left unchanged. A fringe growth approach significantly expands the urban footprint of the cities.



Dispersion

This approach involves more houses and jobs being created outside of the primary urban areas of Cambridge and Peterborough, mainly in the market towns. It could also involve the creation of new towns and villages where previously there was only farmland/countryside.



Transport corridors

A transport corridors approach focuses on developing jobs and housing along public transport routes that radiate out of the main cities. Transport corridors can include fast bus, tram, or train links that provide rapid transit into cities.

“Cambridge is at a decisive moment in its history”

“I have my life back on track now, so thank you... it carries huge meaning”

What do you do if you are unemployed, facing mounting debts and have been left behind by a digital-by-default world in which just about everything – including Universal Credit – requires access to the internet?

Some of the most deprived areas in England are located in the eastern region. When a local housing association, with the help of Cambridge University researchers, launched a project to help those furthest away from the job market, the results were impressive.

Krystal*, a single parent, had lost her way “with bills, my debt and my life in general”. Her situation was complicated, with a number of debts, and she had received an eviction notice from her housing association. Krystal needed to learn basic IT skills before she could think about applying for a job.

Krystal is one of a group of 300 men and women across Cambridgeshire who, over the past two years, have taken part in

a programme that aimed to help them feel in control of their money, teach them how to get online and give them the tools to look for work.

The project, called New Horizons, is the brainchild of a Cambridge-based housing association – CHS Group – and seven other partner organisations, including the University of Cambridge.

Lynne McAulay, New Horizons Project Manager at CHS Group, explains what prompted the initiative: “People who are furthest away from the job market often have really entrenched problems. They’re in dire straits... debt, disabilities... they’ve almost always been left behind by the digital world.

“We could see how a small amount of individualised coaching across a range of areas might get them back on track.

There are services out there to help, but what makes this programme different is that we cover the three elements of money, digital and work at the same time. Digital skills in particular are a massive issue as Universal Credit is rolled out, given that the application process for benefits is online.”

The programme is run with the help of Dr Gemma Burgess and her team from Cambridge’s Department of Land Economy. The researchers helped to design the programme, developed tools to assess the scale of issues faced by each participant, and have been monitoring and evaluating the programme as it goes along.

“There are huge inequalities in this region,” says Burgess. “We’ve got a booming growth area focused around a knowledge economy, and we have rural areas focused around the agri-tech

industry, but we have significant pockets of extraordinary deprivation.”

According to government figures released in 2015, 16 of the most deprived areas nationally include wards in Cambridge, Wisbech, Huntingdon and Fenland.

“Deprivation is scored in various ways, including crime, health and barriers to housing,” explains Kathryn Muir, who has been evaluating the New Horizons programme with Burgess. “Cambridgeshire’s highest-scoring reason for deprivation is housing affordability and homelessness. New Horizons is aimed at the people who are most vulnerable to running up rent arrears, to not managing their debts, to falling out of the system completely. In other words, those who face the prospect of a downward spiral towards homelessness.”

The 300 participants in New Horizons were referred to the programme by social services and other agencies, including housing associations and job centres, based in King’s Lynn, Wisbech, Cambridge and Peterborough.

When they start, many participants feel they have reached the end of the line: “I was in a bit of a state financially... I was down the foodbank, getting the food parcels”; “It was just getting me down and down and down, where I was getting to the point where I’d just had enough”; “It was a really bad year; nothing good happened... I really want to get back into work. I miss working”; “It’s easier to move than it is to pay a debt”.

“What we’ve learned is that people prefer to tell their story only once, not multiple times to different services,” says McAulay. “The coaches listen, and a relationship is built on ‘oh, you can actually make a difference here’ – food vouchers or a grant for a cooker, for instance – and it progresses into something more enabling, where the coach supports a person to make phone calls themselves and to take charge of their money problems.”

The programme offers up to 20 hours of coaching support through the partner organisations. The first task is to get participants onto a stable base, from which they can build their skills and move towards a better understanding and control of their money. They might also need specific advice with moving onto the correct benefits, or speaking to creditors to make their repayments more manageable. The coaches then focus on building digital skills, if required, by encouraging participants to work through courses and learning modules online.

The involvement of the University researchers has been constant throughout the ‘action research’ project, as Burgess explains: “We’ve been looking at how the referral process is working, whether the

coaching is helping, what the participants think... we build a picture as we go, looking for patterns of success and for any problems, and we feed everything back to CHS and the delivery partners so they can adapt as they go along. CHS really wants this programme to improve lives – an action research approach gives the best possible chance of this happening.”

In November 2018, Burgess and Muir completed an evaluation of New Horizons.

In brief	
What	Inequality, housing, poverty, digital inclusion, employment, skills
Where	Cambridge, King’s Lynn, Peterborough, Wisbech
Who	CHS Group, Dept of Land Economy

**Of 120 completing the programme
55 reduced their priority debts
46 set up an email account
34 had an interview
24 started volunteering
22 entered paid work**

“What’s apparent is how successful the programme has been,” says Muir. “A total of 120 people have completed it so far. Of these, 55 reduced their priority debts, 46 set up an email account, 34 had an interview, 24 started volunteering and 22 entered paid work.”

“Obviously, schemes like this can’t fix everybody’s problems,” adds Burgess. “But for some people, it’s transformational in terms of finally getting out of debt, using a computer for the first time, opening their first bank account, applying for a job. It’s important to us that our research is practical and policy focused, and that it is going to have a real-world impact. That’s why we work with organisations like CHS who are out there delivering positive outcomes for people.”

One participant said: “I have my life back on track now, so thank you... it carries huge meaning.” For McAulay, client feedback like this is a large part of the motivation underpinning the project, for which CHS Group is now seeking renewed funding: “You can hear how people have valued that one-to-one relationship with the coach and how it has effected change in themselves – how they’ve moved from feeling like a passive receiver of a service to someone who is feeling responsible for themselves and capable of making change. It’s inspirational.”

*Krystal (name changed) now feels in control of her money, has started a job in a local café and signed a new contract with her housing association. Her coach helped her to negotiate repayments for her priority debts and to attend appointments with the local Citizens Advice. While her money situation was improving, Krystal borrowed a laptop and improved her IT skills to find employment opportunities and improve her CV. “[The coach] gave me the courage to speak to debtors and sort it,” Krystal explains. “I am now in a supported place where I feel in control and it feels great.”

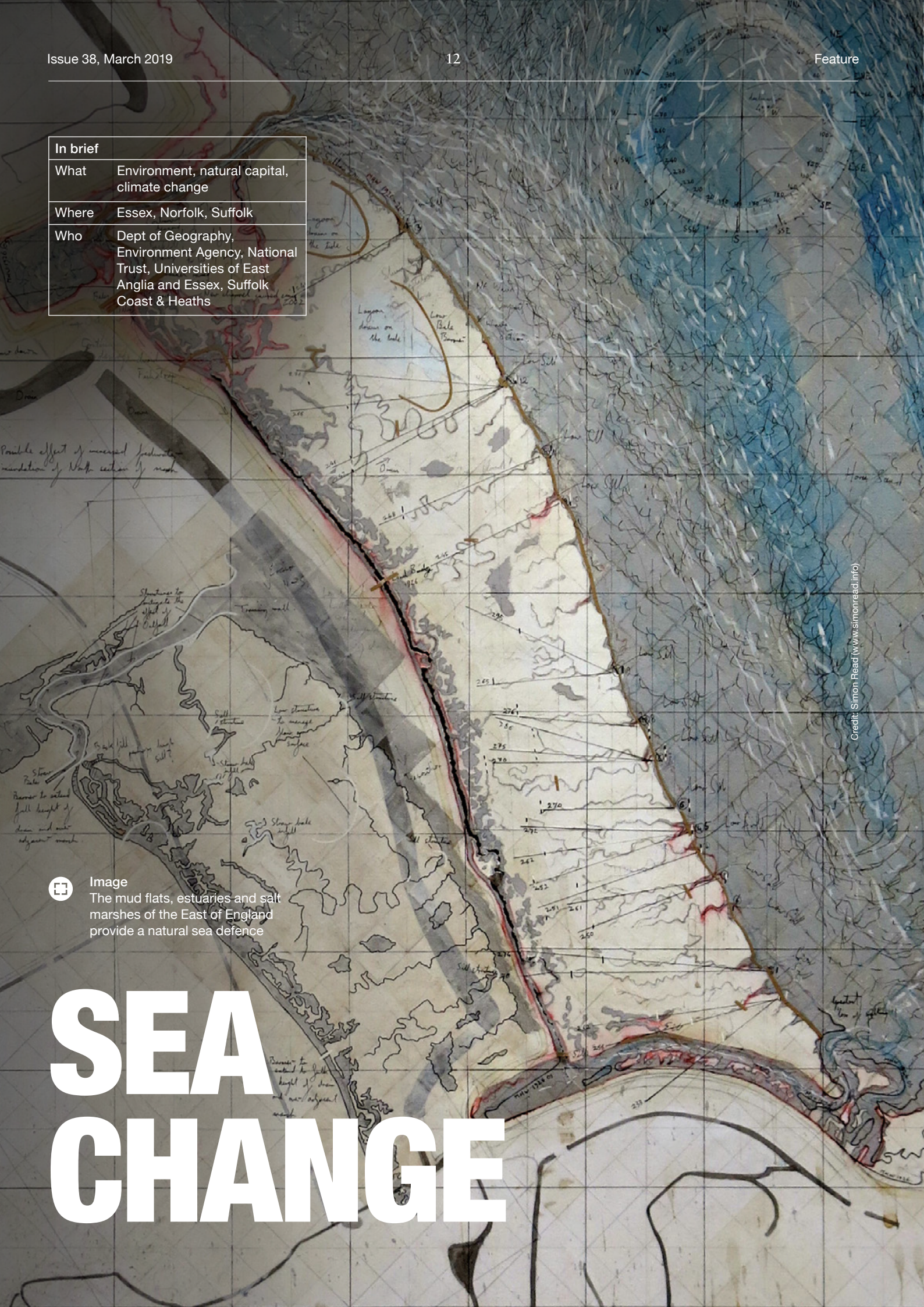
New Horizons is a partnership of eight organisations across the former Greater Cambridge Greater Peterborough Local Enterprise Partnership: Axiom Housing Association, Broadland Housing Group, Centre 33, CHS Group, Citizens Advice Rural Cambs, Cross Keys Homes, Norfolk Citizens Advice Bureau and the University of Cambridge Centre for Housing and Planning Research. It is funded through the Building Better Opportunities programme with funding from the European Social Fund and the National Lottery through the Big Lottery fund.



Words
Louise Walsh

In brief

What	Environment, natural capital, climate change
Where	Essex, Norfolk, Suffolk
Who	Dept of Geography, Environment Agency, National Trust, Universities of East Anglia and Essex, Suffolk Coast & Heaths



Credit: Simon Read (www.simonread.info)



Image The mud flats, estuaries and salt marshes of the East of England provide a natural sea defence

SEA CHANGE

The coast is an intrinsic part of British identity – and perhaps nowhere is it more at risk than in the East of England. Cambridge researchers are working with communities and organisations across the region to manage the coast for the future, by working with nature rather than against it.

It was the worst natural disaster experienced by Britain in the 20th century. On 31 January 1953, the east coast was battered by high tides, storm surge, wind and large waves, leading to devastating flooding. In Norfolk, Suffolk, Essex and Lincolnshire, 307 people were killed. Nineteen were killed in Scotland, while across the North Sea in The Netherlands, 1,800 people lost their lives.

There is plenty of blame to go around for the 1953 disaster, although most would point the finger at the absence of a coordinated warning system, which meant that many communities were unaware of the imminent risk until it was too late. Coastal defences such as sea walls had not been properly maintained or were not equipped to deal with the ferocity of the conditions that night.

In the aftermath of the 1953 flooding, major improvements were made and the UK now has one of the best storm forecasting systems in the world. Existing coastal defences were improved, and new ones like the Thames Barrier were built. The Thames Barrier is an example of a ‘hard’ coastal defence: in many parts of the country, such as where there is important infrastructure or a major population centre, this is the most appropriate protection against rising tides or storms.

But for a country whose cultural and historical identity is so closely associated with the sea, are large concrete or metal barriers always the best defence? And – less romantically – given the enormous financial cost of these defences, are there other effective and sustainable methods we could consider?

“Many of the coastal defences that were strengthened following the 1953 storm surge are now reaching the end of their natural design life, and it’s expensive to repair or reconstruct these sorts of structures,” says Professor Tom Spencer from Cambridge’s Department of Geography, and Director of the Cambridge Coastal Research Unit.

“If you start to think about the predicted sea level rise and severe storms due to climate change, you might need to replace existing defences with something even higher, which is not as simple as adding a bit on top of an existing structure.”

Spencer and Deputy Director Dr Iris Möller are studying how coastal communities can work with nature, rather

than against it, to protect them from flooding. The researchers are collaborating with local authorities in the East of England, the Environment Agency, stakeholders including the National Trust, and the Universities of East Anglia (UEA) and Essex, to develop and test more sustainable approaches to flood defence.

With much of its flat, marshy landscape lying at, or just above, sea level, the East of England is particularly vulnerable to coastal erosion and flooding. According to the most recent UK Climate Projections, the region could see anywhere up to 1.15 m of sea level rise by 2100. It is also home to some of the richest farmland in the country, vital national infrastructure and major tourist areas such as the Norfolk Broads.

The coastal landscapes of the East of England also help protect the coast and those who rely on it by reducing the damage that storm surges can do. “One of the interesting things over my career has been the change in view of these sorts of landscapes, from being areas of relatively low value, to now, where they are rightly viewed as being very important,” says Spencer.

“The mud flats, estuaries and salt marshes along the eastern coast are not only areas of high biodiversity and effective carbon stores, but they also have an important protective function,” says Möller. “We’ve shown in tests that they are highly effective at buffering waves in front of hard defence lines, reducing the waves’ height and potential for damage. To protect our coastal communities and infrastructure, we need to start thinking about having a coastal zone incorporating natural defences, rather than a hard coastal line alone.”

In large-scale tests funded by the EU and the Natural Environment Research Council, Möller and colleagues have shown that even in extreme conditions, narrow fringes of salt marsh just 40 m wide can reduce the height of waves by close to 20%, while an 80 m width of salt marsh can reduce waves to near zero.

The Cambridge researchers, along with colleagues from UEA and Essex, are working with the Suffolk Coast & Heaths Area of Outstanding Natural Beauty (AONB) to test how effective salt marshes and other ‘natural capital’ assets are. The Suffolk AONB was chosen to host one of four Pioneer projects, funded by the UK Department for Environment, Food and Rural Affairs (Defra) to inform implementation of the government’s 25-year environment plan, announced in January 2018.

“The coastal sediment is so soft in this part of the country,” says Peter Cosgrove, Marine Pioneer Project Manager at Suffolk AONB. “Large swathes of hard defences aren’t practical here, which is why the Suffolk

Coast is an ideal site for the Pioneer project: we can look at different ways to work with nature to protect this magnificent landscape which attracted the AONB designation.”

The work of Möller, Spencer and their academic collaborators is fundamental to the Suffolk Marine Pioneer project. “We need to understand the quality and quantity of salt marsh that we have, the services it provides and who benefits from those services,” says Cosgrove. “There’s a lot of information to be gathered, and with the best available science, we can build coastal strategies that deliver for the coastal communities.”

UP TO 1.15 M SEA LEVEL RISE BY 2100

The National Trust is a major landowner in East Anglia, and is also working with the researchers to build coastal adaptation strategies for the next century and beyond. With natural flood management funding from Defra, the team is quantifying the effects of salt marshes on wave decay and water movements. Having looked at the conditions on the open coast, this work is now looking in the upper areas of estuaries.

“Part of the advantage of working with Tom and Iris is that they have long-term thinking embedded into everything they do,” says Daniel Leggett, Coastal Projects Manager for the National Trust. “We’ve got a responsibility to the properties we own to manage them for the future, so we want to know about the range of changes that might happen and plan accordingly.”

He adds: “With a changing climate and dynamic coastline, it may not be possible to keep everything where it is now. The National Trust will live well beyond my lifetime, so it’s important for us to develop plans which enable us to adapt to a changing environment so we don’t lose all of this: we’ve got to put our resources where they’ll do the most good over the long term. That’s what we get from working with Tom, Iris and their team: good science helps us make good decisions.”

“In addition to developing better coastal defences, we also need to work with coastal communities to help them adapt to a changing coastline,” adds Möller. “It’s not about controlling nature but about working with it as part of coastal management.”



Words
Sarah Collins

In brief	
What	Education, employment, skills, social mobility
Where	Cambridgeshire, Norfolk, Peterborough, Suffolk
Who	Faculty of Education, Network for East Anglian Collaborative Outreach, Anglia Ruskin University, schools across East Anglia



Can I Pick Your Brains?

Raising teenage aspirations across the region

East Anglia has long struggled to bridge the gap between school leavers and higher education. The reasons for this are complex but, as a new network of universities, further education providers and schools is discovering, the region does not lack teenage aspiration. The key to improving social mobility – say researchers and frontline staff – is helping young people to make informed confident choices.

In Felixstowe Academy’s sports hall, a 15-year-old is carefully extracting a pig’s eyeball from its socket. “It’s really inspiring for my art,” she enthuses. “I often draw half-skulls and half-faces.” Liberty Pinner, a Year 10 student, is one of 60 teenagers from Felixstowe and Ipswich who are taking part in a very hands-on operating theatre experience.

Over much of the day, the students dissect brains, inflate lungs and explore intestines under the watchful eye of a trained clinician. “I usually find science boring,” Liberty says, “but I’m really enjoying this. I learn hands-on so much better.” Liberty has no intention of entering the medical profession but she does have a plan: “I’m focusing on the creative side – I’m thinking Level 3 BTEC.” Liberty leaves little doubt that she will make this happen, but in doing so she

will buck a stubborn trend in her corner of the UK.

In 2017, six of the UK’s 50 most severe social mobility ‘coldspots’, identified by the Social Mobility Commission, were in the East of England. While the region’s schools performed relatively well overall, it retained five of the worst performing areas indicated by outcomes for pupils eligible for free school meals. For this reason, the region now commands a quarter of the ‘Opportunity Areas’ receiving UK Department for Education funding to improve educational outcomes – in Fenland and East Cambridgeshire, Ipswich and Norwich.

Grades remain a significant obstacle to social mobility in the region but this is not the only challenge. Two years ago, the government identified East Anglia as being one of the least successful parts of the country for converting solid GCSE attainment into participation in higher education.

And so, while the region’s story is partly about deprivation, it is also one of exciting untapped opportunity, as Professor Anna Vignoles, from Cambridge’s Faculty of Education, explains: “Our research shows that, for many, a degree continues to be a vitally important route to a good job and higher earnings.

“It is particularly important that we make sure that young people who have achieved well at school, and who clearly have huge potential, are made aware of the options that are available to them. They need to be encouraged and supported to aim high.”

The government has taken this on board, and East Anglia is now home to the largest of 29 consortia in England funded as part of the National Collaborative Outreach Programme (NCOP) to deliver projects tailored to the needs of this specific group of students.

For the first time, the region’s five universities and eight of its further education colleges are working together with the common goal of helping young people with little or no experience of university to explore the world of higher education. *collaboration to help youth*

Launched in January 2017, the Network for East Anglian Collaborative Outreach (neaco) has been working with more than 10,000 students from Years 9 to 13 who live in areas identified by the government as having low rates of progression to higher education. These include urban, rural and coastal areas of deprivation.

“We’ve discovered that our differences as institutions are our strength,” says neaco Project Manager



Credit: All images, Lloyd Mann

Tom Levinson, based at the University of Cambridge – the administrative lead. “This brings a huge amount of opportunity to young people in this region.”

At the centre of neaco's approach is a programme of activities under the banner ‘Take Your Place’, which are delivered to students by 30 Higher Education Champions working in over 80 schools and colleges. The programme includes raising aspirations but also improving students’ understanding of, and preparedness for, applying for higher education.

The project converts research-based educational principles into a set of core teaching techniques such as challenging students to identify the objective of an activity, encouraging them to use and

develop problem-solving strategies and providing ‘scaffolding’ to support progress through difficult tasks.

It also draws on the expertise of Dr Sonia Ilie, from Cambridge’s Faculty of Education, who is the project’s lead evaluator. Ilie’s expertise lies in how different aspects of deprivation affect educational outcomes, and much of her work involves assessing the effectiveness of programmes designed to improve the experiences of young people.

“In the past, there hasn’t been enough understanding about what works,” says Ilie. “Together with the other NCOP consortia, neaco is leading the way by placing evaluation and evidence building at its heart,” she adds. “Our highly

contextualised approach compares the outcomes of young people on the programme right now with students from the same schools, year groups, qualifications and attainment level, the year before we started. With this data, we can clearly establish what neaco’s impact is, and this will help to inform how other programmes are designed and evaluated for years to come.”

The Take Your Place activities – Felixstowe Academy’s eye-removing, lung-inflating event among them – are as diverse as their participants. Earlier in 2018, sixth-formers from Thetford Academy paid a visit to the Norwich office of the insurance company Aviva to gain insights into career prospects. One of the students, Jacek Lipinski, was so impressed that he applied for and secured one of the company’s 16 apprenticeship roles in software engineering.

“I was studying computing and programming but I didn’t know what I wanted to do,” says Jacek. “I liked the atmosphere at Aviva – they take the time to do things carefully and calmly. Seeing the organisation and the software they use first-hand was helpful.”

A more recent event, organised with the Carers Trust, gave a group of 15- and 16-year-old carers from around

*Research and
Strategies*

While the region’s
story is partly about
deprivation, it is
also one of exciting
untapped opportunity



Words
Tom Almeroth-Williams



When Research Begins at Home



Words
Lucy Ward

Encouraging young people to consider higher education is one aspect of raising aspirations – another is to improve the experience of learning in schools. Working with teachers, researchers in Cambridge’s Faculty of Education are breaking down the “artificial walls” between academia and local schools to help improve life chances.

Huntingdon an immersive experience of student life at Anglia Ruskin University Cambridge campus. One of the highlights was learning about the marketing of chocolate in the School of Management and, fuelled with samples, the students worked as a team to pitch a new slogan.

Back in Felixstowe, the whiff of offal is growing steadily more pungent but the teenage surgeons remain focused on the gory task at hand. For some, the opportunity could not be more relevant to their intended career path.

Jennifer da Silva, a sixth-former at Felixstowe Academy, is in the middle of dissecting a brain but pauses to talk, scalpel in hand. “My mum works in shipping and my dad works at the port,” she says. “But I want to be a neurosurgeon. This is the first time I’ve had the chance to see brains. I want to be hands-on early in my degree so I’m looking for those types of medical courses and the different unis that offer this type of experience.”

“These students do not lack aspiration – far from it,” insists Levinson. “They just need the right support to make big choices for their lives, and that’s what we’re providing – in a way that has never been done before.”

In addition to its involvement in neaco, the University plays a central role in Accelerate East, a diverse partnership that seeks to equip young people to participate in East Anglia’s modern high-skills workforce. The University also works with schools through its Area Links Scheme, which enables the Cambridge Colleges to provide advice to schools and colleges across the UK.

Twenty years ago, two head teachers walked into the University’s Department of Education with a proposal. We want to work with you, they told academics, but don’t just come and “do research on us”. We want to work in partnership.

The approach might have met short shrift in more traditional institutions, but the outward-looking Education Department, now the Faculty of Education, was different. Already working closely with over 30 schools on a school-based teacher education programme, and welcoming many teachers onto its Master’s and PhD programmes, it saw the chance to forge new bonds.

Two decades on, School–University Partnership for Educational Research (SUPER) continues to flourish, bringing together academics and teachers from 12 schools around the eastern region. The partners devise and run collective research projects – on topics from pupil engagement to teacher learning – and share findings within and beyond the group.

The latest project has focused on the increasingly critical area of pupil resilience, as Dr Ros McLellan, coordinator of the SUPER network, explains: “Across the UK, mental health



issues in children are increasing while wellbeing is deteriorating. Evidence shows that wellbeing programmes in schools can lead to significant improvements in children's mental health, and social and emotional skills. But we know that funding constraints and lack of prominence given to wellbeing in the inspection framework create real challenges for schools. Our research is asking how resilience and wellbeing can be promoted in a results-driven educational climate."

"The projects work because schools in our region want to work with us"

The group devised a wellbeing survey that was conducted across the partner schools, backed up by detailed pupil interviews. The findings showed that girls and Year 10 students are more vulnerable at secondary school – and that students from low-income backgrounds are vulnerable at all ages.

"The individual schools are now introducing their own wellbeing interventions tailored to the needs revealed by the study, and we'll be working with them as they assess and share the impact of the interventions," says McLellan.

SUPER is one of a range of projects forging direct connections between the Faculty – part of a world-leading university that is often viewed primarily in an international context – and the living, breathing community of pupils, parents and teachers on its doorstep.

Dr Riikka Hofmann, for instance, has been working with local schools on understanding how best to improve students' learning – finding that approaches that draw on interaction and students' ideas can achieve better outcomes. But she has also found that it's not always easy for schools – especially those in deprived areas that are tackling a wide range of pupil needs – to translate research findings into teaching practice.

"We know that teachers find it difficult to take up new forms of learning, no matter how effective research shows them to be," she explains. "Schools may be concerned about the short-term risks for performance outcomes and inspections involved in trialling new practices. Also, teachers in schools serving disadvantaged populations can

hold limiting views of their students' capabilities and be less likely to introduce change."

Hofmann's latest project, backed by an Economic and Social Research Council-funded Impact Acceleration grant, is creating a 'toolkit' to help schools introduce and evaluate effective educational techniques to boost teaching and learning. Her team is working with four eastern region partnership schools in which a high proportion of students face multiple disadvantages, such as financial or language difficulties.

She aims to make the toolkit available to all schools, nationally and ultimately globally. Tried and tested Faculty research, she argues, should benefit all schools, not only those with fewer challenges to divert them, and ensuring this happens is as much part of Cambridge University's widening participation agenda as diversifying admissions. "It is well known that some of the core barriers to raising aspirations among disadvantaged children happen not only at widening participation in terms of university admissions, but also much earlier, in learning opportunities that disadvantaged children have in school.

"We are a university with a global mission and that includes focusing on disadvantaged communities everywhere, including those near us. The East of England has some of the most deprived areas in the whole country. Our work aims to have a positive impact on the people in those communities, and also helps us to understand the ways change can happen in disadvantaged settings."

The busy two-way pipeline linking the Faculty of Education and schools in the region also lies at the heart of a partnership that focuses on exploring the influence of multilingual identity on foreign language learning among teenagers and its relationship with attainment. The education strand of the project, led by Dr Linda Fisher, is part of a large-scale and far-reaching language sciences research programme, Multilingualism: Empowering Individuals, Transforming Societies (MEITS) funded by the Arts and Humanities Research Council.

Working with six secondary schools in the eastern region and another in London, Fisher's team is tracking the academic performance of 2,000 pupils over two years, including monolingual learners studying a second language and multilingual learners adding a further language in the classroom.

Together with teachers, Fisher and colleagues have devised and trialled a package of teaching materials, which begin by encouraging students to recognise that their understanding of

In brief	
What	Education, wellbeing, language, social mobility
Where	Bedfordshire, Cambridgeshire, Essex, Norfolk, Peterborough
Who	Faculty of Education, schools across the East of England

dialects, slang, emojis and even the most basic foreign language ability all represent a form of multilingualism.

"The main idea is to see whether we can we offer young people the agency to develop a multilingual identity if they so wish and to see what the impacts of that are," Fisher says. The results have been positive. "Reflecting on language learning was not only enjoyable for students but also made them more open minded, more aware of the place of language in the world and more inclined to be engaged with language learning in the classroom."

Many students involved in the project reported a change in attitude, seeing languages more as a vital life skill than just another subject to struggle with at school. "I used to think languages only help on holiday," said one. "Now I think languages adapt your brain and help you understand different cultures."

For the academics, meanwhile, all of these projects are creating a model for boosting the chances of research findings making the journey from concept to coalface and having a real impact on school practice.

This level of collaboration between academics and schools is fundamental to the success of the projects, and yet is surprisingly unusual and should not be taken for granted says McLellan: "Whenever I talk about SUPER in other contexts, people are always interested in how we manage to do it because schools and universities often have different agendas, timescales and ideas over what constitutes research.

"The projects work because schools in our region, which is very diverse, want to work with us. This is not just pie in the sky, ivory tower stuff: it is practical, and real, and of use to schools. We've broken down the artificial walls: we're out there."

"This is not just pie in the sky, ivory tower stuff: it is practical, and real, and of use to schools"

“A VERY CAMBRIDGE STORY”

“We have a very important announcement... am I speaking to Dr Winter?”

It’s hard to imagine the moment when a phone rings and it’s the Nobel Committee at the end of the line.

On the morning of 3 October 2018, Sir Greg Winter – winner of the 2018 Nobel Prize in Chemistry, along with Frances Arnold and George Smith – took the call that told him he’d received the greatest scientific accolade of his career.

“It came as a bit of a shock,” says Winter, who is Master of Cambridge’s Trinity College. “I was hoping to have a nice quiet day.”

A few hours later, he was answering questions from the world’s media in a room at the Medical Research Council (MRC) Laboratory of Molecular Biology (LMB) on the Cambridge Biomedical Campus. A few hundred metres away was the lab where, in the 1980s, Winter had pioneered technologies that would have an enduring medical legacy for humankind and contribute to a hundred billion dollar industry.

He and colleagues at the MRC LMB and Cambridge University’s Department of Pathology were the first to ‘humanise’ mouse and rat monoclonal antibodies, opening up their use as drugs for

destroying harmful molecules in human disease. Humanisation involves swapping regions of ‘foreign’ DNA with human DNA to reduce inactivation of the drug by the human immune response.

But even humanisation doesn’t fully eliminate the possibility of an immune response because the specificity of the antibody is still made up of non-human regions. When Winter developed ‘antibody phage display’, for which he won the Nobel Prize, it enabled the discovery of antibodies to almost every type of target using a ‘library’ of human gene fragments inserted into the DNA of bacteriophage virus coat proteins.

The new technology fitted naturally with his expertise as a genetic engineer, as he explains: “I’d been working with mouse antibodies but had never made one and I thought I’d better learn. I went into the tissue culture room, I followed all the recipes, and everything got infected with mycoplasma. I was so angry at the huge waste of time – and I was already a very angry kind of young man. I started thinking there’s got to be another way.”

Part of the ‘Cambridge Phenomenon’

Winter established three spin-out companies to develop the phage display technologies. Among them was Cambridge Antibody Technology (CAT),



Words
Louise Walsh



Image
Campath-1H

which he founded with Dr David Chiswell and Dr John McCafferty in 1989. CAT was acquired in 2006 for £702 million by the pharma giant AstraZeneca and merged with US-based MedImmune, also acquired by AstraZeneca. Currently, AstraZeneca/MedImmune is in the process of relocating to the Cambridge Biomedical Campus.

“For AstraZeneca to decide it wanted to put its weight behind the technology of CAT was a pretty good thing,” says Winter. “The skills are still in Cambridge and they are adding to the UK companies’ repertoire of drugs.”

Today, phage display is one of the core technologies underpinning the work undertaken by MedImmune. Dr Jane Osbourn leads MedImmune’s facility in Cambridge. Looking back to her time as a bench scientist at CAT, she remembers when a brilliant set of minds and emerging molecular biology technologies came together at the right place and the right time.

“There was a cohort of really able intellect in Cambridge – in CAT and other companies, in the MRC LMB and in the University – and what happened was a condensation of that focus,” she says. “Once we decided to make phage display work, we set some really tough goals and then just got on with it.”

At the same time that phage display libraries were being grown to ever increasing sizes (today a trillion phage is the norm), researchers in the University’s Department of Pathology and the MRC LMB were making major mechanistic discoveries about antibodies and their targets, while others in the Department of Chemical Engineering were working with CAT to develop new bioprocessing methods to manufacture them as drugs.

“All of this makes antibodies a very Cambridge story, one that’s been developing over four decades,” says Winter, referring to the discovery in 1975 of how to make monoclonal antibodies by MRC LMB scientists César Milstein and Georges Köhler, for which they won a Nobel Prize.

Monoclonal antibodies are now one of the most important classes of biological drugs on the market, used in the treatment of rheumatoid arthritis, multiple sclerosis, cancer and other diseases.

“Research and development in the antibody field are still very much part of the Cambridge Phenomenon,” adds Osbourn. “It’s a fantastic time for AstraZeneca/MedImmune to base its new global headquarters in Cambridge. There’s a melting pot of ideas and skill sets that we’re tapping into through long-term collaborations with researchers at the University, the LMB, other biotechs and Cancer Research UK. To this, we’re bringing know-how on how you develop drugs, take them to the market and deliver benefits to patients’ health.”

Life sciences cluster

AstraZeneca/MedImmune’s relocation is a major boost to an already booming life sciences cluster that encompasses the Cambridge Biomedical Campus, University departments and the Cambridge Science Park, as well as nearby Wellcome Sanger Institute, Babraham Research Campus and Granta Park.

Greater Cambridge’s life sciences cluster has

430 ORGANISATIONS

contributing around

£2.9 BILLION

annually to the UK economy

In brief	
What	Biotechnology, innovation, life sciences, pharma
Where	Greater Cambridge
Who	Medical Research Council Laboratory of Molecular Biology, Dept of Pathology, MedImmune, AstraZeneca

According to a report commissioned by AstraZeneca in 2018, over 430 organisations in the cluster support a specialised workforce of more than 15,500, contributing around £2.9 billion annually to the UK economy. If it continues to grow at its current rate, the cluster has the potential to contribute a further billion per annum to the economy by 2032 and could provide 6,000 additional jobs.

“This is just the beginning”

The “Cambridge story” is not just one of a thriving life science industry. It is also one where medical success is often underpinned by decades of incremental steps. Take the example of Campath-1H, the first antibody to be humanised and which today is marketed as Lemtrada to slow the progression of multiple sclerosis. It was developed from research that began in 1979 by Professor Herman Waldmann in the Department of Pathology.

“There was a culture that we should be tackling difficult problems – things that might not get results for 20 or 30 years,” says Winter. “I can’t pretend that I anticipated the work would be so commercially successful. It was a paradigm shift to consider a biological molecule as large as an antibody as a drug. We had to convince people that they could be used as therapeutics and it was biotech companies that took it on board.”

The gains have been huge. Humira®, for instance, was discovered at CAT using phage display and is now the bestselling drug in the world – earning more than \$103 billion since entering the market in 2003. Now owned by the pharmaceutical company AbbVie, it’s been dubbed “the Swiss army knife of pharmaceutical drugs” because of the number of inflammatory conditions it can treat (15 and counting).

“It’s true that over the past 30 years the development of antibody therapeutics has delivered a step change in disease treatments,” adds Osbourn. “But research and development can never stand still. We must always think that this is just the beginning.”

Faced with shifting demands on landscapes and climate change, how do you plan for a forest's future?

Thetford Forest is a unique 47,000-acre landscape in the East of England. Working among its patchwork of pines, heathland and broadleaf trees, Cambridge University PhD student Eleanor Tew is helping the Forestry Commission plan for the next 100 years of the forest's life.

The forest has been carefully managed since its beginnings nearly a century ago, when the Forestry Commission was tasked by the government with reforesting a nation depleted by the demands of the First World War. Today, Thetford Forest is prized for the value of its timber and its biodiversity, and attracts a million-plus visitors every year.

But modern forestry faces new challenges. "Around a third of global forests are managed for timber production, but these forests also play a vital role in helping to look after the planet's biodiversity, water, soil and carbon," says Tew, who works with Professor William Sutherland in the University's Department of Zoology. "Management strategies are increasingly looking to balance the economic needs of forestry with the maintenance of resilient and functioning ecosystems."

All these goods and benefits – its 'ecosystem services' – need to be considered by the Forestry Commission when it designs strategies for the nation's forests. And, because trees take so long to grow, these strategies need to be 'future-proofed' for up to 100 years so that trees planted now will continue to thrive and be of benefit to future generations.

Tew has been examining over 40 different management options in Thetford Forest with the Forestry Commission, who sponsor her research alongside the Natural Environment Research Council (NERC). For each option, she has looked at its impact on up to nine different ecosystem services: timber production, carbon sequestration, water supply, soil quality, recreation, scenic beauty, heritage values, wildlife and conservation.

"Different management options often lead to trade-offs between different ecosystem services," she explains. "So a conifer monoculture might give you excellent timber production but lower recreational benefit, whereas a mixed broadleaf forest might be relatively low on timber but high on biodiversity."

"Intelligent planning against an uncertain future needs both accurate evidence and informed insight," says the Forestry Commission's Jonathan Spencer, Head of Planning and Environment. "Eleanor's research is providing us with both, leading to a better understanding of management

options, and how we can maximise the various benefits in decades to come."

Planning a century ahead becomes an even greater challenge with climate change, as Tew explains: "The warming climate brings more pests and more diseases, which can slow or stop growth, or kill trees entirely. Forestry monocultures and broadleaf woodlands are being affected all over Europe. Just in terms of timber, if you think of a forest as a bank account and the tree's growth as its interest, then planting the wrong species for the climate at the end of the century risks considerable loss in value when that tree is harvested."

That's why diverse management strategies are currently being explored, she says. Understanding the effects of these options is imperative, and needs to be detailed if it is to increase 'natural capital' resilience.

"One of the great aspects about working with the Forestry Commission is having access not only to their databases of management strategies and timber projections, but most importantly also to their staff with their wealth of expertise and experience," adds Tew, who has been working closely with the Planning team in Thetford Forest. "Together, we've been able to ensure that my research is as applicable and helpful as possible by focusing on the range of management strategies under consideration for the future of the forest."

"But I also needed to get into the realms of understanding the difference between planting one tree species or another in different locations – which meant gathering new evidence, such as over 600 soil samples from across the forest."

Her aim now is to embed her research by working full time at the Forestry Commission for three months after her PhD, thanks to NERC funding through the National Productivity Investment Fund, which is linked to the government's Industrial Strategy.

She will soon begin summarising her results for the Forestry Commission, helping them to make decisions on a case-by-case basis, putting theory into practice. This could include deciding what species to plant or what management strategy to adopt in a new planting area.

"Eleanor's work has challenged us to think more deeply and to act more wisely as we face up to the threats to forests arising from climate change and the opportunities of enhancing the wider ecosystem services we provide," adds Spencer. "We have no doubt that similar studies will be pursued in other forests, as her work comes to fruition and is adopted across the country."



Words
Louise Walsh



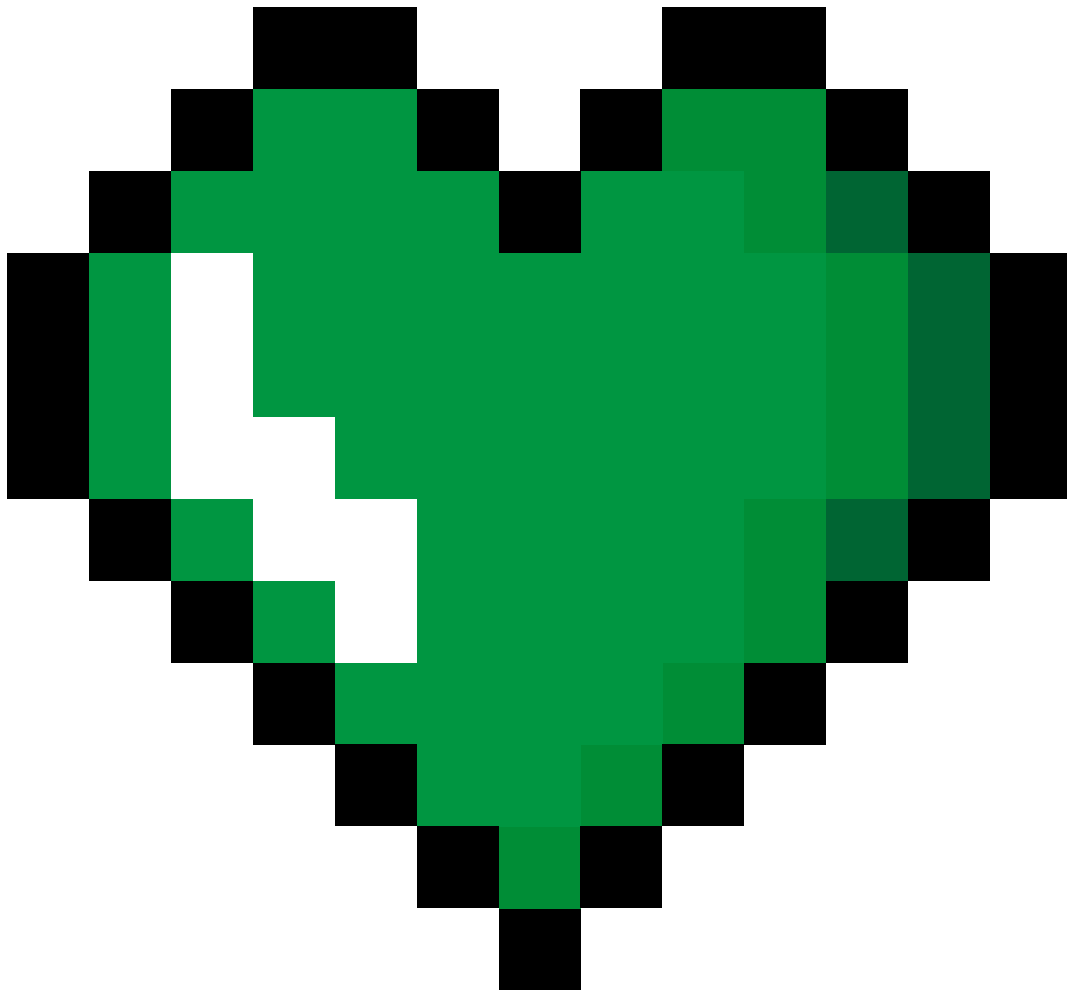
In brief

What Biodiversity, conservation, ecosystem services, environment, natural capital

Where Norfolk, Suffolk

Who Dept of Zoology, Forestry Commission

Future-proofing a forest



Old and young: staying healthy and active in our later years

Improvements in public health, education and medicine mean that our lives are much longer than at any point in human history. Thanks to studies of volunteers from the eastern region, we may be able to spend these extra years living independently and in good health.

It's 9:50am and a group of women are gathering upstairs at Burwell Sports Centre in Cambridgeshire. It's a cold winter's day and the chairs are scattered with thick coats and bags; the women are drinking tea, chatting, occasionally exploding into laughter. They're here for

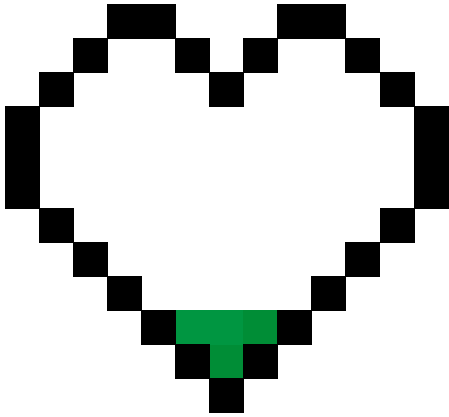
the over-55s tai chi class. "Initially I joined to meet people, but it's good fun, we have a laugh," says Pat, 73. She has asthma and has had joint replacements, so this gentle class is perfect for her. "It's not a 'difficult-difficult' class. It's not like we're doing press-ups or anything."

Her friend Jane, 69, agrees. "It's all exercise, but it's also about getting out and socialising."

Pat and Jane are among an estimated 12 million people aged over 65 living in the UK, a figure that's expected to exceed 17 million by 2035, accounting for almost one in four people. As we age, our bodies

become weaker and more prone to disease: rates of diabetes, heart disease, cancer and dementia increase dramatically. Often an individual will be living with several conditions. This places an increasing burden on our health services, which have already been described as at "breaking point".

What if we were able to live longer while still maintaining good health and our independence? This is the ambition of the 'Ageing Society' Grand Challenge, part of the UK government's Industrial Strategy, which aims to "ensure that people can enjoy at least five extra healthy, independent years of life by 2035".



By 2035,
almost 1
in 4 people
will be aged
over 65

Targeted screening

One approach to achieving the goal of the Grand Challenge is to encourage people to adopt healthier lifestyles – better diet, more exercise, keeping active in old age, as Pat and Jane do, for example – and thereby reduce their risk of disease. A second complementary approach is to identify those who are at highest risk of disease or have undiagnosed conditions and to intervene, through innovative diagnostic tools and treatments.

But how do we identify people who have undiagnosed conditions, particularly if they are yet to show symptoms. Could the answer lie in screening programmes?

Possibly, says Professor Simon Griffin at the Cambridge Institute of Public Health. “But,” he says, “while a minority of people will benefit from a screening programme, everyone may be harmed to some extent. There’s the anxiety that can accompany the test, the investigations that may be

In brief	
What	Ageing, health, technology
Where	Cambridgeshire, Fenland, Norfolk
Who	Cambridge Institute of Public Health, Cambridge Academy of Therapeutic Sciences, Addenbrooke’s Hospital, Dept of Computer Science and Technology

necessary to confirm a positive test, the diagnosis itself, the false reassurance of a negative test...”

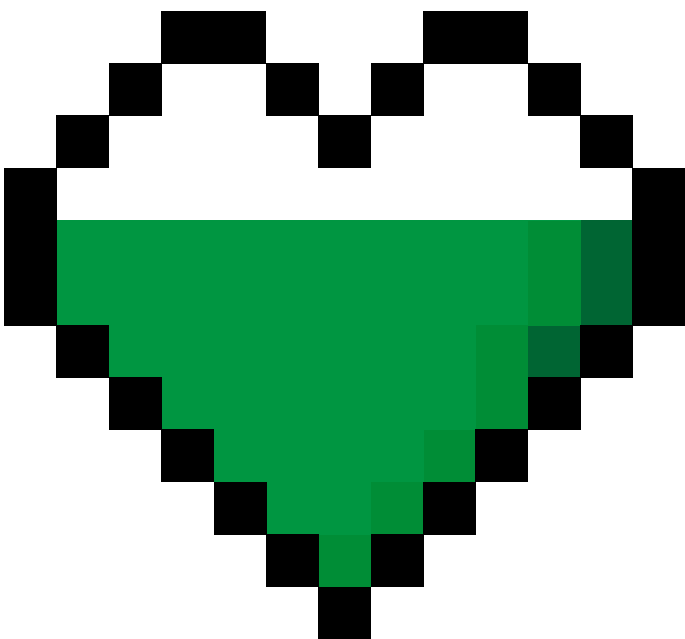
To understand whether screening is worthwhile, he says, you need to demonstrate that early treatment is better than late treatment, and you need to quantify the associated harms. It turns out that few tests meet the criteria set down by the National Screening Committee when it is considering recommending the establishment of a programme.

“The belief that screening will reduce harm is widely held. But it’s almost folklore. Complex problems rarely have simple solutions,” he says.

One way to reduce potential harms is to stratify people in terms of their risk profile and target screening at those with highest risk. Working with cohorts in Ely, in Cambridgeshire, and Norfolk, Griffin showed that it is possible to calculate an individual’s ‘risk scores’ for type 2 diabetes and cardiovascular disease based on factors such as age, weight and family history. Screening targeted at those with the highest scores is effective at identifying – and potentially preventing – new cases of diabetes and cardiovascular disease, with potential cost savings. These findings contributed to this approach being rolled out across the UK in the NHS Health Check programme.

Griffin is working with Professor Jonathan Mant to trial whether systematically screening people for atrial fibrillation – an irregular heartbeat – can cost-effectively identify those individuals who are affected. One in 10 people over the age of 65 will have this condition, which can be difficult to detect but is responsible for a third of all strokes and has been linked with an increased risk of heart attack and dementia.

The feasibility study is under way in the eastern region, with screening taking place at home: participants use a small, portable heart monitor twice a day to take recordings that are sent automatically for analysis.



Wearable technology

Helping people monitor their health at home could prove essential as our population ages, says Professor Chris Lowe, Director of the Cambridge Academy of Therapeutic Sciences. “It costs £700 to £800 a day to look after someone in hospital, so really you want to keep people in the home environment. That’s where technology will come into play.”

There is already a huge market for ‘wearable’ technology to monitor health, facilitated by the ubiquity of smartphones, the speed at which data is processed and, increasingly, advances in AI. Over 300,000 health-related mobile apps are now available, covering almost every conceivable condition.

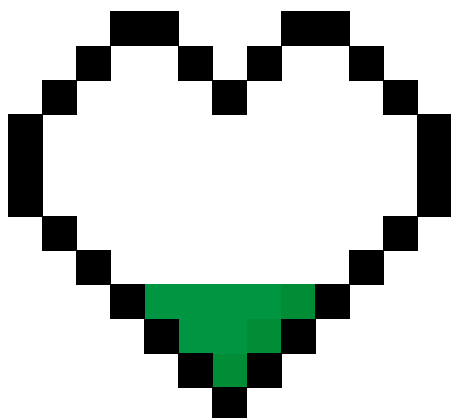
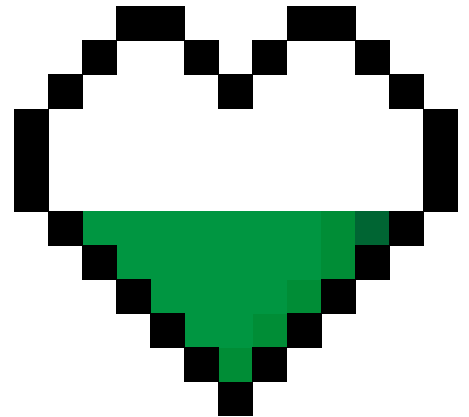
“But while algorithms – the computer code that powers AI – are getting better and more accurate, they still have some way to go before clinical decisions can be made on the basis of their measurements,” says Lowe.

“Tech companies might have to be willing to share the apps’ decision-making processes with regulators such as the National Institute for Health and Care Excellence, and there will need to be agreement about who is responsible in case of error or harm, or unexpected consequences. There might also be issues around take-up among the older generation, and questions of privacy around sharing personal health data.”

If we can overcome the barriers, the potential is huge, he says: gadgets to monitor heart rate, glucose levels and the amount of oxygen in our blood; gadgets to monitor an elderly parent remotely

to ensure they don’t forget to take their medication and to watch out for – and even predict – falls. Augmented and virtual reality might help alleviate symptoms of dementia, depression or phobias.

Lowe and colleague Dr Gita Khalili Moghaddam, for instance, are working on a wearable technology for monitoring diabetes: contact lenses that monitor tear fluid as a surrogate for blood sugar. The lenses contain holographic sensors that change in response to glucose levels, the idea being that patients take a picture of the lens *in situ* to tell them how high their glucose levels are using a smartphone app.



Sense your life

Computer scientist Professor Cecilia Mascolo, co-Director of Cambridge’s Centre for Mobile, Wearable Systems and Augmented Intelligence, in the Department of Computer Science and Technology, also sees technology playing an important role in monitoring disease. “[Wearable and mobile devices] are very powerful. They can really ‘sense your life’: your location, your activity, your emotions to an extent, your interactions... all of which could be really useful for clinical care.”

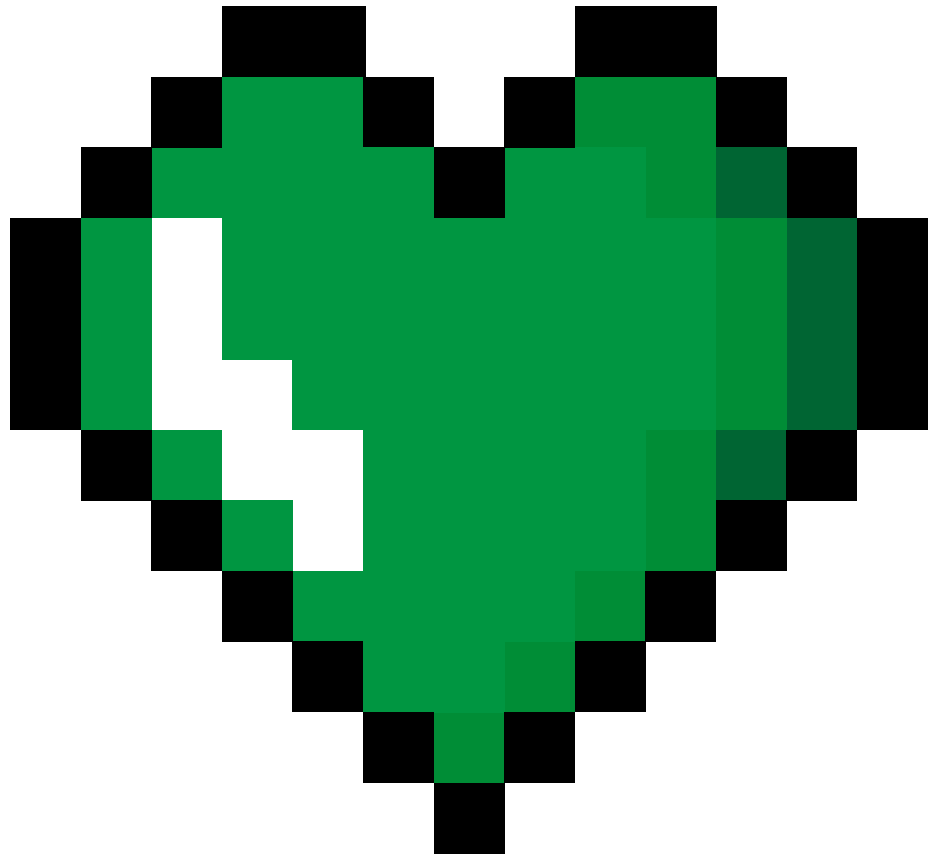
Mascolo is working with Dr Dennis Chan, a neuroscientist and consultant at Cambridge’s Addenbrooke’s Hospital, on apps that could help monitor the progression of dementia. One of these will look for changes in how we navigate around our environment, as problems with spatial navigation are among the first signs of dementia. Other apps will look for changes in sleeping patterns, or in memory and cognition.

There is a danger, however, that new technologies may further exacerbate inequalities between those who have access to them and those who do not. The government’s Grand Challenge acknowledges this problem, stressing the need to narrow “the gap between the experience of the richest and poorest”.

“Wearables tend to be used by highly educated, often very fitness-conscious, people,” says Lowe. “If we want everyone to benefit, then who will pay for those from low socioeconomic backgrounds to access this technology? Is the state going to pay? Like a lot of things they’ll slowly percolate down, but unless the government gives incentives, it will take a long time.”

“It costs £700 to £800 a day to look after someone in hospital, so really you want to keep people in the home environment. That’s where technology will come into play”

“Health of the body, disability... all of these things are tightly aligned. If you can do the things in society that enhance the potential for brain health in later life, you’re going to be doing a lot that’s good for every life stage”



Public health

Professor Carol Brayne, Director of the Cambridge Institute of Public Health, welcomes the Grand Challenge as potentially offering a “win-win” situation to improve health in later life while helping stimulate the economy but, like her colleague Griffin, she warns against relying entirely on simple solutions to complex problems.

“Gadgets may play a part in improving an individual’s health and allowing them to age healthily, but we need to do research that looks at where gadgets, smartphones, and so on are the right approach, and where we really need to act as a household unit, or as a community, or as a society. There are no magic bullets.”

The Grand Challenge aims to help “drive improvements in public health and innovate across the social care sector”. This is welcome, says Brayne, though she argues that the investment in research and innovation should include investment into developing and evaluating public health measures, not just into technological solutions.

There are some grounds to be optimistic. Brayne leads the Cognitive Function and Ageing Studies (CFAS) project, a multi-centre study of dementia and cognitive decline in ageing. Volunteers from Ely have

contributed to the study. More than 5,000 people aged 65 and over from the city and its surrounding area have taken part in cross-generational studies during the past three decades.

In fact, CFAS is one of a number of cohort studies at Cambridge University that look at populations in the East of England and ask what we can learn about the relationships between genetics, health, our behaviour, the environment and health. For instance, 30,000 men and women aged 40–79 have been involved in the EPIC Norfolk Study, while more than 12,000 people from Cambridgeshire have been involved in the Fenland Study.

A key – and perhaps surprising – finding from CFAS was that the UK has seen a 20% fall in both the prevalence and incidence of dementia over the past two decades. When this finding was published, Brayne was quoted as saying: “The so-called dementia ‘tsunami’ is not an inevitability: we can help turn the tide if we take action now”.

The fall can almost certainly be viewed as a success for public health measures that improve education, early- and mid-life health promotion including smoking reduction and attention to diet, and physical activity. As well as reducing dementia risk, all of these factors contribute to healthy ageing.

“So much else goes along with brain health,” says Brayne. “Health of the body, disability... all of these things are tightly aligned. If you can do the things in society that enhance the potential for brain health in later life, you’re going to be doing a lot that’s good for every life stage.”

At Burwell, Fara Afifi, the tai chi instructor, begins gathering her class in the studio. The class is popular: there must be 20 people, mainly women. As they begin their warm-up, Pat puts down her tea and stands to join them.

“It’s not a serious class, ‘cos we’re all slightly older,” she says, laughing. “I tried that Zumba once, and I could barely get home!”



Words
Craig Brierley

In brief

What	Heritage, identity
Where	Cambridgeshire, Peterborough
Who	Cambridge Archaeological Unit, Museum of Archaeology and Anthropology

The teenager was buried on a bed in Trumpington Meadows outside Cambridge, her head raised as if on a pillow. Under her chin was an extremely rare early Christian gold and garnet cross.

Who she was remains a mystery, but the cross identifies her as one of England's earliest converts to Christianity, and makes this 7th-century grave one of the oldest Anglo-Saxon Christian burial sites in Britain. Because early converts were from noble families, the teenager may have been of aristocratic or even royal status.

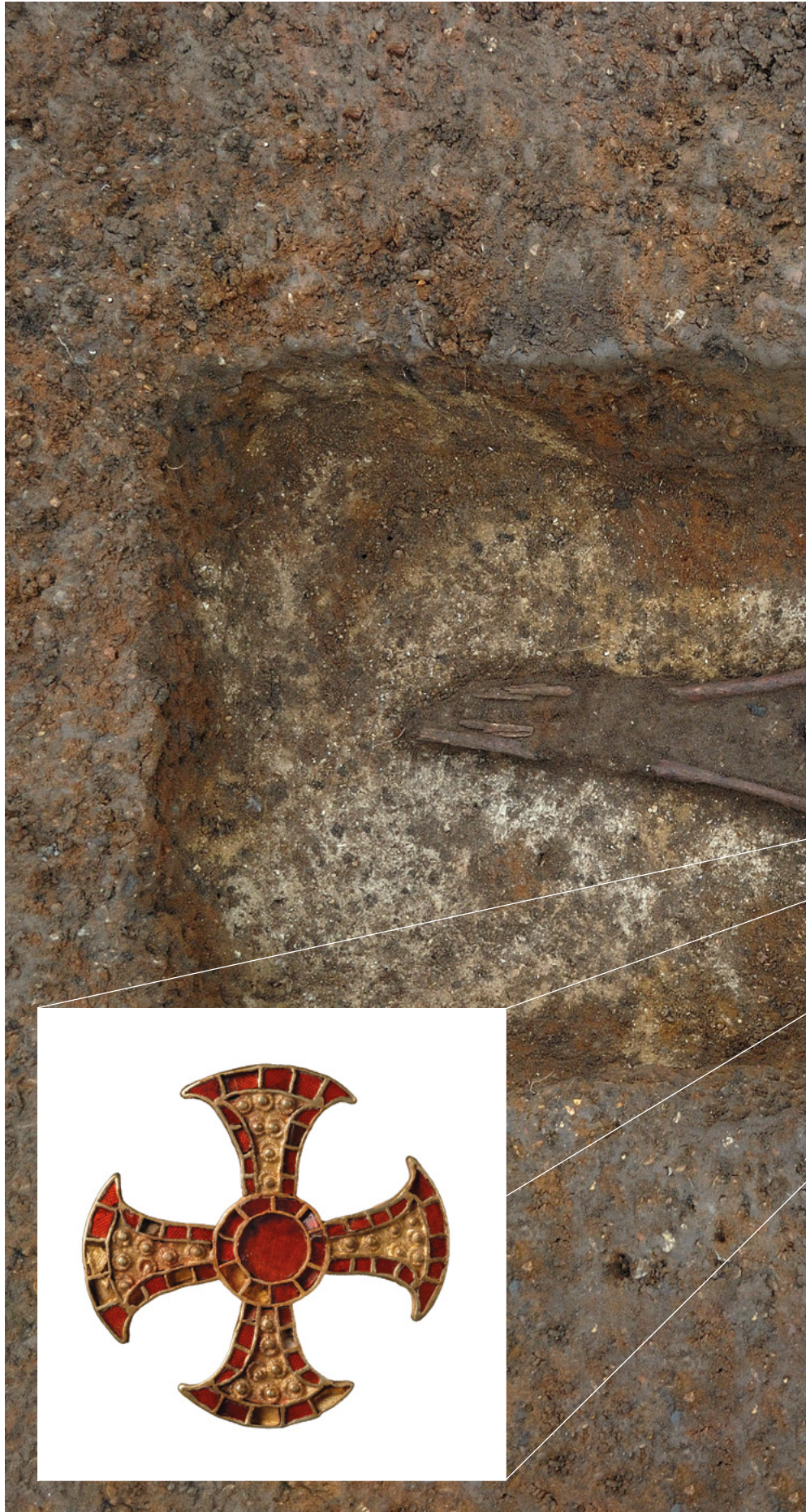
The bed burial is among a series of extraordinary discoveries made across the region by the Cambridge Archaeological Unit, including Must Farm – a Bronze Age settlement dubbed Britain's 'Pompeii' for its significance – and, more recently, a Roman villa at Eddington in North West Cambridge.

"That this is a bed burial is remarkable in itself – only the fifteenth ever uncovered in the UK – add to that a beautifully made Christian cross and you have a truly astonishing discovery," says Alison Dickens, who led the excavation for the Cambridge Archaeological Unit in 2011.

Aged 16 to 18 years old, the girl was buried in fine linens with gold pins, an iron knife, glass beads and a chain that would have hung from her belt. Hers was the most recent of a tight group of four graves buried over a period of two or three generations.

The 'Trumpington Cross' is now on public display for the first time in Cambridge University's Museum of Archaeology and Anthropology, just a few miles from the village where it was discovered. The lavish grave goods take pride of place in the Museum gallery, says Senior Curator Dr Jody Joy: "The Trumpington Cross and pins are of international significance and quality, possibly even made for royalty, but with the strongest connections to Cambridge and the surrounding settlements. Their generous gifting by the landowners will allow us to tell the story of an important chapter in the region's heritage and identity."

Details of the Trumpington excavations are published in the McDonald Institute Monograph Series (2018) by C. Evans, S. Lucy and R. Patten.





Credit: All images: Cambridge Archaeological Unit and Museum of Archaeology and Anthropology

THE BED BURIAL

Businesses need the skills to adapt to new technologies, such as 3D printing, but when they emerge fast and change quickly, how do workforces plan for the future? University researchers are collaborating with small and medium-sized enterprises in the region to help find the best upskill strategies for driving innovation.

Five years ago, 3D printing was hailed as a technology that would fundamentally transform the way that most things are made: the hype cycle was in full gear. Breathless columns were written about a world where Star Trek-style replicators would be in every home, and no less a figure than former US President Barack Obama claimed that 3D printing would change manufacturing forever.

Fast-forward a few years and, while 3D printing has advanced rapidly, many companies still aren't sure whether they should use it, how they should use it and what skills they need to use it effectively.

Tim Minshall, the Dr John C Taylor Professor of Innovation and Head of Cambridge's Institute for Manufacturing (IfM), likes to use the example of 3D printing to illustrate the challenge that the East of England – and the UK at large – has with skills. With funding from the Engineering and Physical Sciences Research Council (EPSRC) and the Economic and Social Research Council (ESRC), he has been studying the potential impact of 3D printing on companies of all sizes, including some in the local region.

When a new technology is developed, among the first questions often asked are: how many jobs will it create as new business opportunities are realised, and how many people need to be trained to capture these opportunities? But according to Minshall, when it comes to acquiring the right skills to best exploit new technologies, those are the wrong questions.



Words
Sarah Collins

SKILLING UP, SMART

“New technologies come along and we think we need new skills to be developed to use them, when the truth is it’s knowledge about these technologies that needs to be developed – and that’s a more difficult problem,” he says.

“If you’re a small manufacturing firm, and you’ve been doing business in a broadly similar way for decades, and then someone comes along and tells you that you need to get on board with this new technology or you’ll be left behind, how do you know whether that’s actually true? Should you buy the new solution that’s being offered to you, and if you do, do you need to retrain all your staff, or even recruit new staff, to make sure you’ve got the skills to be able to use it?”

According to Minshall, companies need to be asking who needs to know about the technology, and what they need to know.

“If a company invests in a new technology but hasn’t thought about these issues, it could be a disaster for their business,” says Minshall. “We run research projects that aim to help companies of all shapes and sizes, but in particular smaller ones, to develop the skills and capabilities they need to adapt to these technologies.”

Minshall’s colleague Professor Duncan McFarlane is working on such a project. Also funded by the EPSRC and in collaboration with the University of Nottingham, the three-year Digital Manufacturing on a Shoestring project is looking to help small and medium-sized enterprises (SMEs) use digital information to enhance their manufacturing operations.

“In Cambridge and the surrounding area, there are two fundamentally different types of SMEs: the small manufacturers who make things and the solution providers. The programme aims to support both of these types of SMEs.”

One of the aims of the Digital Manufacturing on a Shoestring project is to provide SMEs locally and across the country with the building blocks to make the right solutions for them.

“We want to get straight to the heart of the digital challenges that manufacturing SMEs are trying to overcome,” says McFarlane. “SMEs want inexpensive and easy digital manufacturing solutions: they haven’t got large specialised IT departments. There are numerous examples of companies investing into digital solutions which turn out to be no benefit at all because they haven’t been developed in line with their needs, and they haven’t got the right skills to use them effectively. And if we can engage local IT solution providers in developing these right solutions then it will be a double win!”

UK government policy is focused on improving productivity through its Industrial Strategy, which is “backing businesses to create good jobs and increase the earning power of people throughout the UK with investment in skills, industries and infrastructure.”

McFarlane says that the approach he and his team are developing could help manufacturers be more effective, which could in turn help productivity numbers. “We’re approaching SMEs who have productivity challenges to help them understand to what extent digital or automated solutions could help them if they can afford them, and then we are helping them piece together low-cost automation solutions,” he says. “In particular, we are making use of non-industrial digital technologies – low-cost computing, wifi cameras, voice recognition systems – because they are cheap and getting cheaper.”

“Technology is moving so fast... how do we know what skills are needed by who and how they get them?”

While the Digital Manufacturing on a Shoestring project is fundamentally research, McFarlane says there is also a technology transfer aspect to their work, as they try to find the best fits between the digital requirements of different types of SMEs and the low-cost solutions under development.

In 2016, in collaboration with the government’s Department for Business, Energy and Industrial Strategy, researchers from Cambridge’s Centre for Science, Technology & Innovation Policy (CSTI) in the IfM developed and ran a pilot project that also tried to match up skills and industries, but with a policy slant. Their case study for this ‘industrial-innovation system’ approach was Agri-Tech East, a membership organisation comprising farmers, growers, scientists and entrepreneurs in the East of England focused on innovation in agri-tech.

“We wanted to quantify what this region is really good at in order to drive innovation,” says Dr Carlos López-Gómez, who led the research and is currently Head of the Policy Links Unit at IfM. “In the East of England, we tend to focus on our strengths in science, and assume that new industries will flow

In brief	
What	Skills, innovation, digital, manufacturing, productivity
Where	East of England
Who	Institute for Manufacturing, UK Department for Business, Energy and Industrial Strategy, University of Nottingham, Agri-Tech East

from that. But, quite often, innovations come from established industries. Our approach allows for a better alignment between distinctive regional capabilities and promising areas for future specialisation.”

According to López-Gómez, priorities for existing regional innovation strategies are too generic and don’t give enough consideration to existing regional economic and innovation structures, or are simply replicated from elsewhere.

For the pilot project involving Agri-Tech East, the researchers found that modern industries increasingly cut across sectors and technologies. By carrying out a comprehensive mapping exercise, they identified various opportunities in the East of England’s agri-tech sector. These were in the arable and horticultural crop sectors, across various stages of the value chain, and were in a combination of disciplines, in particular plant sciences and engineering. Five ‘smart specialisation’ opportunities, including robotics, remote sensing and smart irrigation, were selected for further analysis.

“Claiming you are world class in everything will not be believed, and therefore in an emerging sector like agri-tech it is vital that we collectively agree where our real strengths lie,” says Martin Collison from regional consultancy firm Collison and Associates Limited, who participated in the pilot project. “The Cambridge-led project brought together a wide cross-section of partners to identify where the East of England has particular strengths in agri-tech, and this will support our ability to attract companies and investment to the area.”

“At the end of the day, digital manufacturing and other emerging technologies are just another tool in the toolbox, but they do raise a lot of interesting business and policy issues,” says Minshall. “By looking at those issues, we realise that there are all sorts of problems that require regional and national-level solutions. One of the most important of these is how do we know what skills are needed by who and how they get them. Technology is moving so fast, and businesses want to find the areas where it will be of most benefit to their particular situation.”



FAST JUSTICE OF

From Fenland delinquency to policing Peterborough's streets and the power of prison education, researchers from the Institute of Criminology are engaged in the region to help reduce the harm crime can cause.

Every day, on the streets of cities, towns and even villages across the East of England, young people take decisions that can – in a moment – alter the course of their life and the lives of others. These events do not occur in a vacuum: the wrong combinations of environment, timing, people and experience can result in decades lost to crime and addiction – damaging communities and draining the resources of criminal justice services under increasing pressure.

This year, the University's Institute of Criminology celebrates its 60th anniversary. Researchers from the Institute have spent years in the local region engaging with people at different points of these adverse cycles – from police and prison officers to kids on street corners – to build an evidence base for effective ways to reduce harm caused by criminality.

While providing prevention lessons for the UK and indeed the world, research that was kick-started and, in many cases, continues to run in the eastern region means that local policymakers have an opportunity to build on projects and findings uniquely relevant to their patch.

Perhaps none more so than the Peterborough Adolescent and Young Adult Development Study (PADS+): a large longitudinal study that has followed more than 700 young residents of Peterborough from the age of 12 to now over 24, as they navigate school, work, family and the law.

Led by Professor Per-Olof Wikström, Director of the Centre for Analytic Criminology, the study uses waves of surveys conducted across 13 years that take a singular approach to data gathering. For a given day, the participants are asked to give hour-by-hour detail of where, when, how and with whom they have spent their time. This has been combined with psychological and genetic data, plus two huge surveys each of around 7,000 city residents, to create an extraordinary cross-section of young lives and communities in early 21st-century Britain.

"There is nothing else like this study," says Wikström. "We have the kind of detail other studies simply don't have. We can demonstrate not just where 'hot spots' of crime occur, but why – which can help us predict future crime-prone areas."

In a major book, *Breaking Rules*, the research team showed how certain environments trigger crime, the central importance of personal morality and self-control in "crime-averse" youngsters, and how a third of teens never even consider breaking the law while just 16% commit more than 60% of all adolescent crime.

The researchers are currently finishing off their next book, which will take the study findings up to the present day. "We still have a huge retention rate of 91% for our cohort, many of whom are now back in Peterborough after university and some are now becoming parents themselves," says senior PADS+ researcher Dr Kyle Treiber. "This data has the potential to reach far beyond criminological contexts. There's so much information on everything from education and lifestyle to social mobility," she says.

For Wikström, Peterborough is an ideal city to research the role of people

and environment in crime causation. "It's a diverse place of manageable size, with neighbourhoods at both ends of the socioeconomic spectrum. It's big enough but not too big, so we could cover the whole urban area – and the surrounding Fenland means people tend to live their lives within the city."

He suggests that the research, now being replicated (and its findings supported) in countries from Sweden to China, could prove useful for city planners in the eastern region, as well as police and social services. "Peterborough is an expanding city, and our data could help developers understand what creates crime-prone people and criminogenic situations."

Like all cities, Peterborough has its hot spots: streets or intersections where there is a concentration of theft, violence and criminal damage. These are the areas that some of Wikström's young people know all too well – and policing them is a challenge for a force that works with tightening budgets. To find the most effective ways of reducing crime in neighbourhoods across

"In working with us to conduct experiments, Cambridgeshire Constabulary has set the standard for cost-effectiveness in policing," says Professor Lawrence Sherman, Director of the Jerry Lee Centre for Experimental Criminology. "The results from Peterborough provide an important benchmark for evaluating police time – challenging those who would rather see patrols in safer neighbourhoods or high traffic areas."

Outside Peterborough, those brought up in the fens can feel their opportunities are limited, and rural life presents its own challenges to those working in the justice system.

A new project led by Cambridge criminologist Dr Caroline Lanskey and King's College London psychologist Dr Joel Harvey is exploring how the unique Fenland environment stretching east from Peterborough contributes to youth offending. "There are pockets of the fens where isolation, poor transport links and often high levels of deprivation feed into the types of crime young people commit,"

In brief	
What	Inequality, crime, justice
Where	Cambridgeshire, Fenland, Peterborough, Suffolk
Who	Institute of Criminology, Cambridgeshire Constabulary, HM Prison Service

that risks being wasted. Four years ago, they started an initiative called Learning Together: partnering universities with prisons and probation organisations to build "transformative communities", in which students from both inside and out are taught at the same time by some of the best lecturers in the UK.

The Learning Together team has worked in several prisons in the eastern region, including Peterborough and Warren Hill near the Suffolk coast. It is with Whitemoor, the high security prison that sits just outside the Fenland town of March, that the team has one of their longest-standing partnerships.

THE EAST JUST

Peterborough, University criminologists partnered with Cambridgeshire Constabulary to conduct major experimental trials of police deployment.

By randomly allocating 21 extra minutes of daily foot patrol by Police Community Support Officers to some of the cities hottest hot spots, researchers showed an average drop in reported crime of 39%. They worked out that every £10 spent on patrols would ultimately save £56 in prison costs.

The study has followed more than

700 YOUNG RESIDENTS

of Peterborough from

AGE 12 TO OVER 24,

as they navigate school, work, family and the law

she says. Lanskey and Harvey, with the support of PhD student Hannah Marshall, are working to develop an "explanatory framework" for rural rule-breaking. They are currently conducting interviews, as well as analysing risk assessment data for hundreds of young people from across Cambridgeshire. "The fens can feel defined by distance: geographically, but also socially and culturally," says Lanskey. "Youth justice workers struggle to gain the trust of secluded communities – and struggle to reach them. It can take a whole day to see two or three people." The project is aiming to report back findings later this year.

When the decisions young people make end badly, it can result in imprisonment. Life inside can be harsh – many of the region's prisons have suffered extensive funding cuts, as in the rest of Britain – and, once a sentence is completed, opportunities on the outside can be scant.

For Drs Ruth Armstrong and Amy Ludlow (who, like Lanskey, are in the Centre for Community, Gender and Social Justice), the secure estate holds a vast amount of talent and potential

"We started courses in Whitemoor three years ago, and the prison has bought into this work in really exciting ways," says Ludlow. Bespoke courses on everything from philosophy to creative writing have been taught in Whitemoor; in most cases university students were taken into the prison to learn alongside students currently serving sentences.

"When we move ideas from the learning environment into criminal justice, we show people in prison that they are not defined by their offending, but that there are avenues for them to progress," says Armstrong.

Learning Together has now instigated over 20 university–prison partnerships nationally. "The relationships of trust built with prisons such as Whitemoor have allowed us to create models of working for partnerships across the country. By engaging locally with research, you can end up pushing national agendas."



Words
Fred Lewsey

By analysing supply chains, developing robotic workers and creating multimillion pound crop science centres, University researchers are helping farmers and industry across the region to sustainably increase productivity and profitability.

Under a searing hot sun, jets of water spurt from wide metal arms and patter gently onto the green leaves below. The uncultivated earth nearby is baked dry after months without rain, and the water level in the farm's reservoir in Cambridge is unusually low. Dr David Firman surveys the test plots with a seasoned eye.

Firman's entire research career has been devoted to the potato, a staple crop we produce around five million tonnes of each year in the UK. With the industry worth an annual £2 billion, the trials at this site on the outskirts of Cambridge could have valuable consequences for growers. On this particular day – in one of the hottest and driest summers on record in England – farmers in the eastern region, as elsewhere, faced considerable challenges.

“The difficulties ranged from how can growers best use the water resources they have left, through to specific issues relating to quality problems that might result from the extreme weather. As researchers, we tend to help with these challenges on an advisory basis, but they can also inform future research, which makes this engagement really valuable.”

Firman leads a team of 10 scientists at the farm, which is based at the National Institute of Agricultural Botany in Cambridge. The so-called NIAB CUF facility is known for its world-leading research focused on meeting the future needs of UK potato growers and their customers. Farmers in nearby East Anglia harvest a third of England's entire potato crop, and the team works closely with many of them through the Cambridge University Potato Growers Research Association.

“Of all the water use in agriculture, potatoes use more than any other crop in the UK. In the longer term, we're interested in breeding varieties that might need less water, to help growers make the most of the water they have,” says Firman.

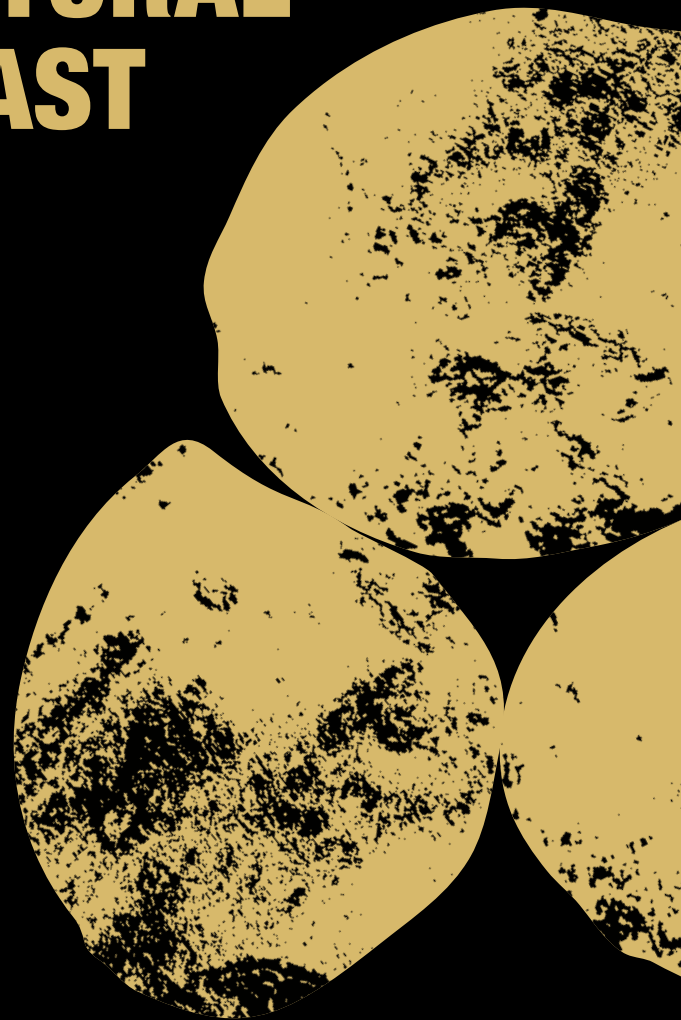
“Water isn't only important for yield but also for disease control. There's a specific pathogen of potatoes that forms a blemish on the tubers. The most effective way of controlling it in susceptible varieties is by watering them in a specific way. Other research is focused on improving soil management and use of pesticides, to improve production efficiency and sustainability.”

NIAB CUF has links with the Cambridge Global Food Security Interdisciplinary Research Centre (IRC), a University-wide network concerned with the challenges of meeting the rising food needs of a growing population. Their collaborative work has enabled the exploration of opportunities to improve productivity in one of the UK's key industries: agri-tech, which contributes £14.3 billion to the UK economy and employs 500,000 people.

Improved agricultural productivity would contribute to economic growth in Fenland, which accounts for about half of England's most highly productive farmland. Of all the crops grown to a significant scale, potatoes are one of the more complex.

A £2 BILLION VEGETABLE AND THE AGRICULTURAL FUTURE OF THE EAST

**“ Around
55 TONNES
of potatoes are produced
per year for every hectare
of cultivated farmland,
but the optimal yield is
100 TONNES ”**



One potato, two potato...

The complexities of the potato crop are not just confined to the field, but reach all the way to the table, as Dr Mukesh Kumar at Cambridge's Institute for Manufacturing has been discovering. Kumar studies the dynamics of supply chains of products ranging from cars to milk. He recently teamed up with representatives from potato industries to investigate why potatoes have one of the highest waste problems of any commodity crop.

"Our first step was to map out the potato supply chain from beginning to end," says Kumar. "We were amazed to find that it involves up to 23 key actors – from seed developers, producers and growers, to farmers, processors and retailers."

He found that the main 'hotspot' for waste is at the farm, and that the

processing industry was keen to address waste occurring from the farm to the factory gate. "Around 55 tonnes of potatoes are produced per year for every hectare of cultivated farmland, but we know the optimal yield is 100 tonnes. The difference is caused by many factors, some natural and some due to farmers having limited access to resources and technological expertise. This gap between expected production and real production is a huge waste of resources."

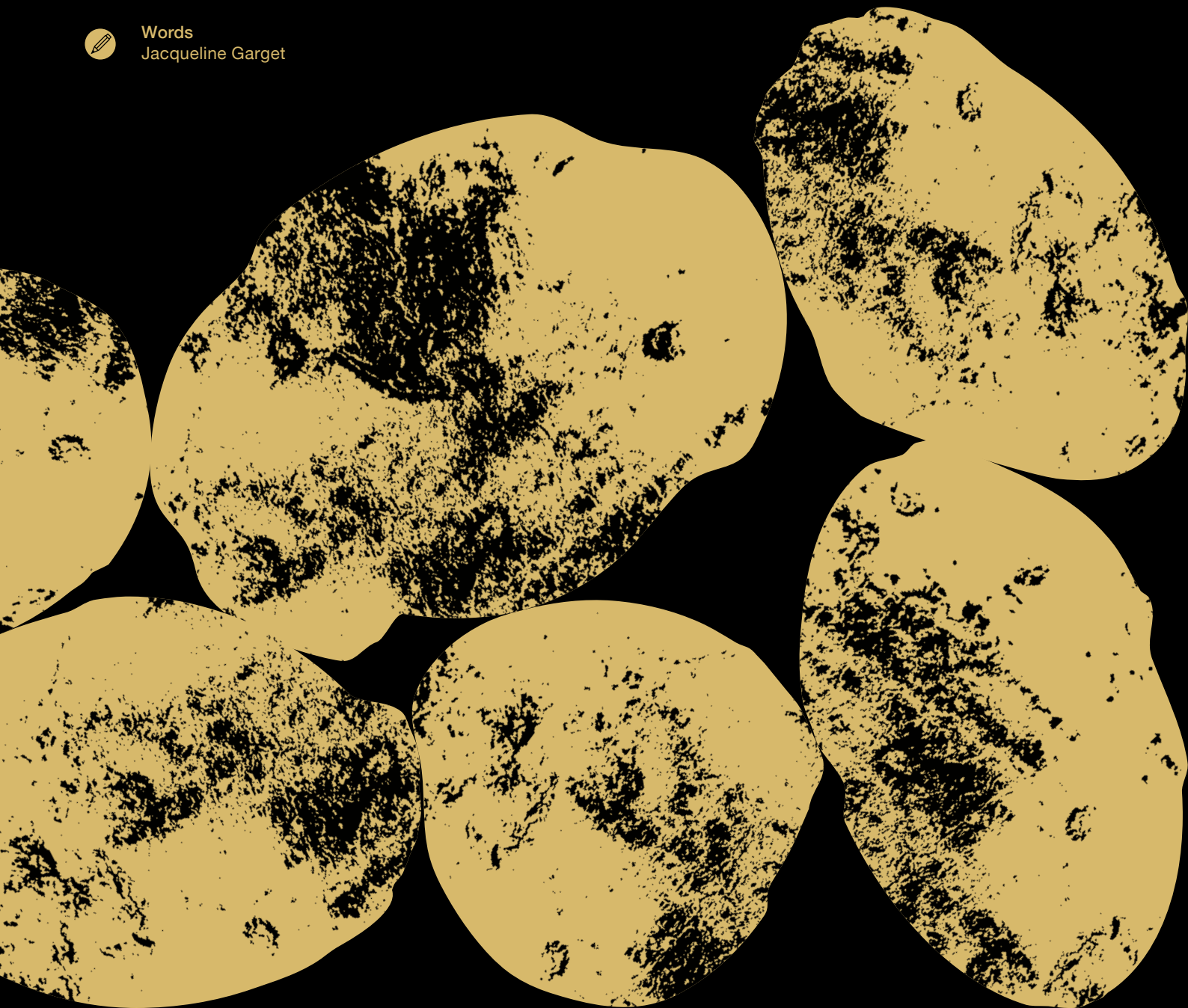
Kumar believes the team has just scratched the surface with this pilot study; now they need to look at the wastage issue in more depth to design better solutions for farmers. "To understand our food system properly, and improve resilience and profitability, we have to continue to work closely with the growers."

In brief	
What	Agri-tech, automation, food security, innovation, productivity, waste
Where	Cambridgeshire, Fenland, Hertfordshire, Norfolk
Who	National Institute of Agricultural Botany, Cambridge Global Food Security Interdisciplinary Research Centre, Institute for Manufacturing, Dept of Land Economy, Defra, Agri-Tech East, Dept of Engineering, G's Growers, Ceres, Cambridge Centre for Crop Sciences, Dept of Plant Sciences



Words

Jacqueline Garget



Farm economics

Ben Lang in the Department of Land Economy's Rural Business Unit also works with the farming industry: he leads Cambridge's involvement in the Farm Business Survey. Commissioned by the government's Department for Environment, Food and Rural Affairs (Defra) and supported by the farming unions, the survey has gathered data since 1936 to become the largest and most authoritative source of information on the economics of farm businesses in England. Lang's team leads on the collection of information from over 300 farms in the East of England.

"We'd encourage every farmer in the East and nationally to use the results of the Farm Business Survey," says Lang. "They can use it to see how their business compares with others like their own, and start to understand the differences. A wheat farmer, for example, can compare the costs of crop protection with other farm businesses. If they're high, it will prompt the farmer to think about whether these costs are justified. Are they resulting in a high yield of high-quality produce, or not?"

The team also uses information from the survey in a 'Projection Calculator' to help farmers see what their accounts might look like in a few years' time. Extrapolating existing data according to the predicted future prices of key inputs like fertiliser and energy creates a useful tool for farmers.

"If one crop uses more energy than another, for example, then at a time of rising energy costs that crop would become less competitive," says Lang. "It can help farmers understand the effects of changing market conditions and adjust their practices accordingly."

The survey is the go-to data source for the UK government in formulating agriculture policy, says Lang. "It's the only resource that portrays the true economic situation facing farmers and rural businesses."

Bio-inspired robotics

One policy announced by the government in early 2018 was support for the development of high-tech innovations to make UK agri-businesses more productive and profitable, while improving resilience and protecting the environment.

Someone who recognises the complexity of this challenge is Dr Belinda Clarke, Director of Agri-Tech East, an 'innovation hub' of farmers, growers, scientists and entrepreneurs focused on improving the competitiveness of agriculture.

"Aligning the expectations of farmers with the nature of cutting-edge research is a challenge," says Clarke, "and some of the frontier discovery research is quite a long way from market. Part of the skill is in being able to introduce farmers to research and innovation at different places along the 'technology readiness' spectrum – from the very blue-sky, to the more applied work that's closer to market, and helping them to appreciate the potential impact. It's all about bringing innovation to end users in a way that's immediately applicable to them."

As an active member of Agri-Tech East, the University is building connections across the whole breadth of the agri-food chain. In the Department of Engineering's Machine Intelligence Laboratory, Dr Fumiya lida wants to apply his expertise in robotics to the automation of agricultural processes. He's interested in the challenge of creating robots that can effectively deal with 'soft' objects, like fruit and vegetables, without damaging them.

"Robots are really terrible at manipulating soft objects," says lida. "It's so easy for us humans, but robot technology is designed for a rigid world. Assembling cars, for example, is much easier for them compared with manipulating fruit and vegetables." Using an electrically conductive soft

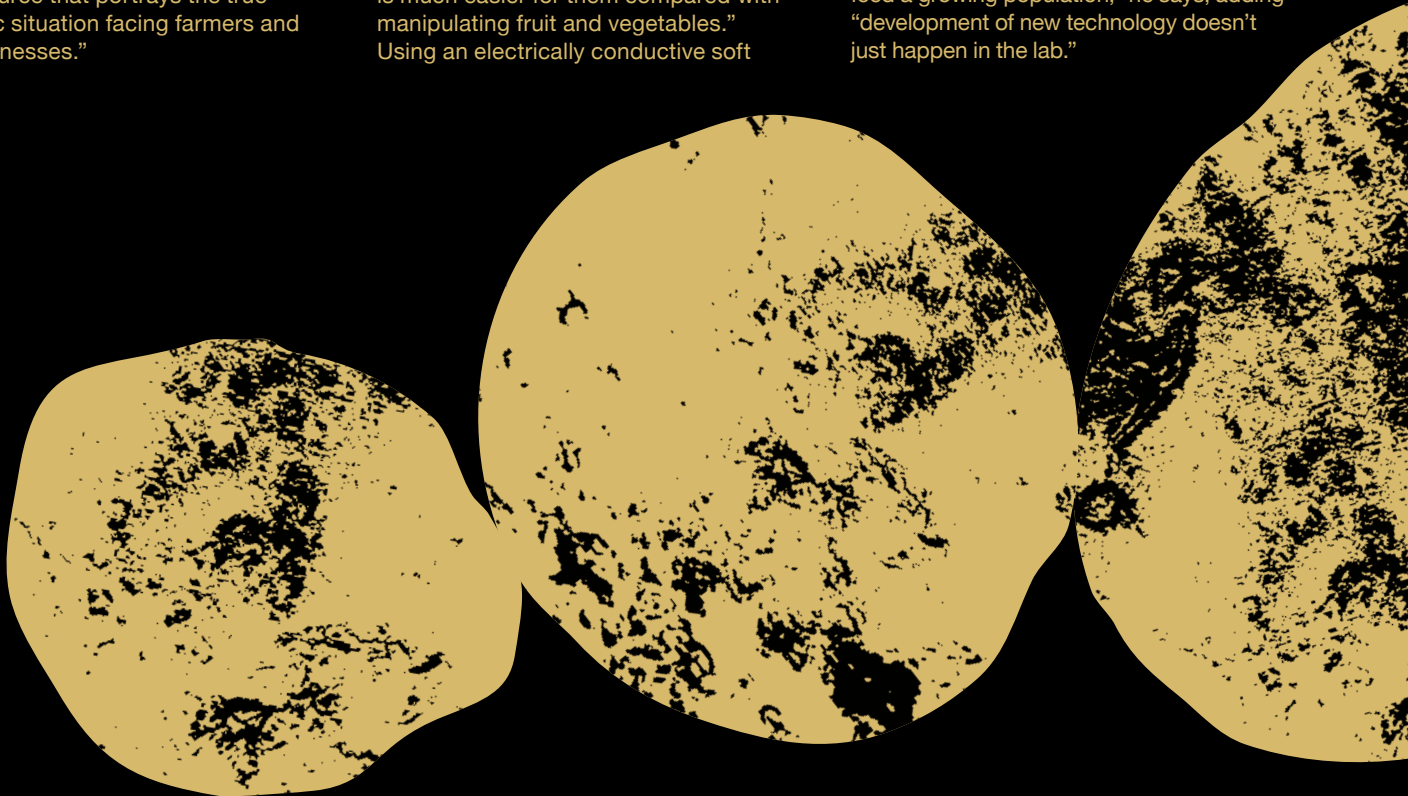
material, he's making robots that are sensitive to light, chemicals and other stimuli, enabling them to deal with uncertain tasks in unstructured environments, like farmers' fields. He calls his work 'bio-inspired robotics' – looking at biology and why humans are good at certain tasks, and trying to create robots to do the same.

Soft robots could have many applications, from harvesting crops, to packaging or quality control, to peeling and wrapping vegetables. "Across the supply chain there are so many challenges of soft manipulation," says lida. "Robots could work in conditions that are terrible for human workers, like cooking beetroot in vinegar for the supermarkets. Imagine working in a noisy, hot, smelly factory all day long – at the moment humans have to do it because there's no other solution."

He adds: "We have many agricultural companies in East Anglia and they're all aware that automation is the future for farming, but they don't know where to start. And we don't know where to start because we don't know what the problems are." By bringing the two groups together through targeted workshops in Cambridge, conversations are starting to happen and collaborations are beginning to emerge.

Clarke says lida is just one example of the real willingness of researchers not just to disseminate knowledge generated within the University, but also to take on board the knowledge from within the farming community and embed it in research thinking for the future.

lida is collaborating with G's Growers, based in Cambridgeshire, to automate the beetroot cooking process and to develop a soft robot to harvest vegetables such as lettuce. "Automation is necessary if you want to scale up agricultural processes to feed a growing population," he says, adding "development of new technology doesn't just happen in the lab."



Innovation to commercialisation

lida has been awarded a Royal Society Translation Award to investigate the potential to commercialise a lettuce-harvesting robot. For others wishing to commercialise their agri-tech innovations, the recently established Ceres Agri-Tech Knowledge Exchange Partnership may be able to help.

Established through a Research England Connecting Capability Fund Award, the partnership links the Universities of Cambridge, East Anglia, Hertfordshire, Lincoln and Reading, and also the John Innes Centre, NIAB and Rothamsted Research. Its £4.5 million investment fund will help to develop viable agri-tech projects derived from the research of Ceres university partners towards commercial propositions that businesses can invest in.

“Ceres is a really exciting opportunity for the ever-growing agri-tech cluster in the East of England, particularly for projects that don’t have a defined route to market,” says Ceres Coordinator Dr Geoff Elliott. “We’re looking forward to working with university and industry partners to bring the latest innovative research out of the lab and into practice. Ultimately our work will benefit the government’s Industrial Strategy and the UK economy, but – in line with the University of Cambridge’s mission – first and foremost we want it to benefit society.”

Future crops

Developments in modern biotechnology and plant breeding will play a vital role in meeting future food demands. To advance capacity, the University, in collaboration with NIAB, is creating a Cambridge Centre for Crop Sciences (3CS) in which researchers will work with industrial partners to translate the University’s strong fundamental plant research into practice for farmers, processors and consumers. Construction of a major new facility on the outskirts of Cambridge is due to be completed by 2020, as is the recruitment of a new Crop Science Professor to lead the work.

Professor Sir David Baulcombe from the Department of Plant Sciences has long championed the new Centre: “The molecular biology of plants has gone through a revolution in the past 30 years. With genome sequencing to help us, we can now develop crop varieties with the traits we want – like water efficiency or disease resistance – much more quickly than through traditional breeding methods. Our goal is to translate these advances into technologies for agriculture that will support rural economies, deliver higher crop yields and reduce environmental impacts.”

The 3CS will focus on furthering agricultural innovation and productivity, benefiting farmers in the eastern region and

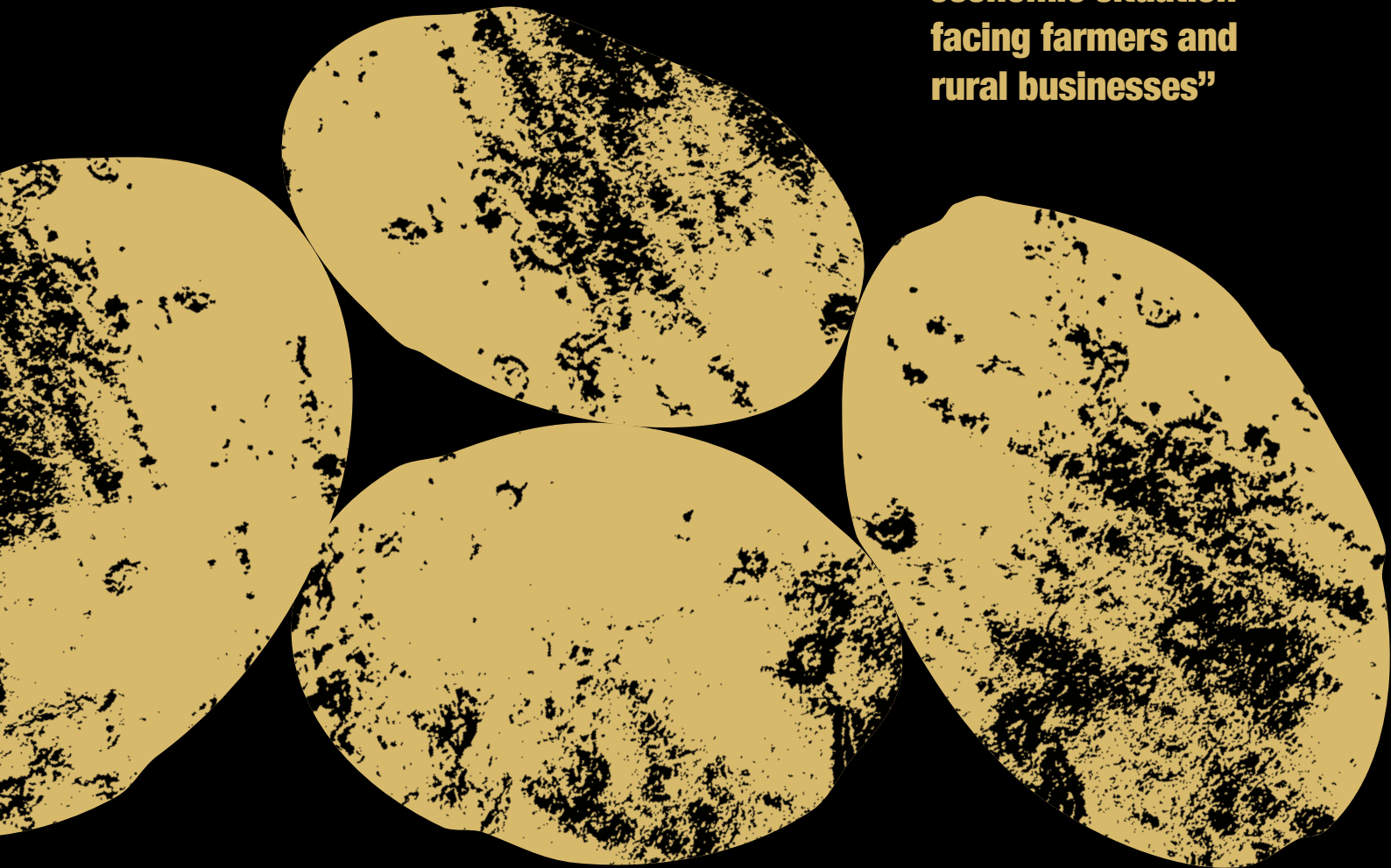
elsewhere, including smallholder farmers across the developing world.

Professor Howard Griffiths, Co-Chair of the Cambridge Global Food Security IRC, is confident it will be a successful new model for translating research into practice: “Research and industry are very different communities, with different challenges and priorities. We need to get the various stakeholders to work together as an ‘innovation community’, to identify and tackle the key challenges and help deliver the UK government’s agri-tech strategy.

“The eastern region is rich in agricultural research facilities and in end-users for agri-tech innovation, with arable farming and horticulture as major industries. 3CS provides a real opportunity for the East of England to become the global centre for agricultural innovation.”

Back at the farm, Firman can see from the work at NIAB CUF the value of long-term continuous engagement between growers and researchers. “We won’t solve the big problems overnight. But together, we can see what needs to be done and get on with it.”

“The survey is the only resource that portrays the true economic situation facing farmers and rural businesses”



Physician, heal thymself

The National Health Service turned 70 in 2018 – but, amid the celebrations, its health is faltering. By working closely with local hospitals and GPs, researchers at Cambridge University are developing bold new ideas they believe will help the NHS thrive for decades to come.

Alongside the Chinese People's Liberation Army, Indian Railways and Walmart, the NHS ranks among the world's largest employers. In England, it treats more than 1.4 million patients every 24 hours and will this year spend £126 billion. But as communities gathered to celebrate the NHS's 70th birthday in 2018, reports continued to emerge on the ailing health of this much-loved national institution.

Analysis by another national treasure, the BBC, revealed that nearly one in five hospital trusts were failing to hit any of their key waiting-time targets. Hospitals seemed to be lurching towards over-crowded A&Es, bed shortages and queuing ambulances unable to hand over their patients.

Two University of Cambridge researchers have a grand vision to rethink the system to make it fit for the next 70 years – a vision that's rooted in research with local patients and doctors.

Professor Stefan Scholtes works at Cambridge Judge Business School and Dr Alexander Komashie is at the University's Engineering Design Centre. Both are engineers by training, both have spent the past 10 years studying different parts of the local healthcare system and both are passionate believers that, as researchers,

they can help make the NHS better.

The NHS faces numerous challenges but the real test, says Komashie, is understanding how to design better delivery systems by working with patients. "That's where engineering comes in," he says. "Engineers excel in designing large systems that work well, from worldwide telecommunications networks to the Airbus A380. What motivates me is translating the engineering practice of a systems approach into healthcare."

The first step is understanding the system requirements. "It sounds obvious, but to design a system to do something you need to understand what it is you want," Komashie explains. "In engineering, a lot of effort goes into defining what the system should do. When you understand that, you can ask how the system is set up to deliver it."

Komashie has applied this systems engineering approach to adult mental health services within the Cambridgeshire and Peterborough NHS Foundation Trust (CPFT), and ran a series of workshops for patients and clinicians. Patients' stories allow him to unpack each component of the delivery system and represent them in visual diagrams so that services can be improved in a systematic way. The project was funded and supported by the National Institute for Health Research (NIHR) East of England Collaboration for Leadership in Applied Health Research and Care (CLAHRC), hosted by CPFT.

"My goal is developing a new way of describing the system, and hearing people talk about their experience of

care helps me understand it. If through patient and public involvement, we can get rich enough stories, it gives us a window into the system behind the story," says Komashie, who has recently been awarded an interdisciplinary fellowship for research into health systems visualisation at The Healthcare Improvement Studies Institute (THIS Institute). "Hearing patients' accounts of what matters most helps to ensure the system designs and delivers the support they need."

Komashie is now taking the tools he developed in mental health and applying them to vascular surgery and spinal cord injuries at Addenbrooke's Hospital in Cambridge and holistic neuropsychological rehabilitation at The Princess of Wales Hospital's Oliver Zangwill Centre in Ely.

Headlines about NHS waiting times, bed shortages and ambulance queues invariably focus on capacity, which Scholtes argues is a misdiagnosis. "People say we've got a capacity problem but that's wrong. We have a complexity problem. There are so many things going on simultaneously but pulling in different directions. Complexity is killing hospitals."

At Addenbrooke's, for example, where Scholtes spent three sabbaticals over the past 10 years, the hospital does everything from pulling wisdom teeth to multiple organ transplants. He argues that delivering this breadth of services in a system already at full stretch is impossible. Instead, hospitals need to be "decomplexified" by delivering most of their routine services in community settings.

It sounds simple, but it's not. "The problem is that there's no landing space. We have 92 GP practices locally, so how can you move work currently centralised in a large hospital to 92 small businesses? It's impossible. The only way to make headway is to scale up primary care so that it can take on more responsibility," says Scholtes.

This is exactly what he's doing with Granta Medical Practices, a large Cambridgeshire GP practice where he spent his most recent sabbatical evaluating the practice's innovative operational and business model.

A critical barrier to change in primary care is the traditional GP partnership model, he says. By leaving GP partners with unlimited liability, the model creates risk aversion and hampers transformative change. In response, Granta is developing an innovative business model – an employee-owned trust akin to the John Lewis Partnership – which could enable it to deliver 70% of routine outpatient activity in the community and cut by 25% the number of emergency bed days among its patients.

But how can transforming Granta help the NHS as a whole? This is where the University comes in, says Scholtes, who hopes to establish a Primary Care Innovation Academy, drawing on research expertise from across the University.

The Academy would provide leadership and management training for GPs, practice managers and lead nurses,

and also ensure that interventions taken to transform the local primary care system are robustly evaluated. As such, it would add to the University's increasing capacity in creating the evidence base for improving healthcare. For instance, THIS Institute is focusing on how to improve quality and safety across the system.

Addenbrooke's Hospital itself has been transformed over the past three decades with a major emphasis on recruiting clinical academics in partnership with the University, who split their time between practising medicine and carrying out research.

Professor Patrick Maxwell, Head of the School of Clinical Medicine, explains: "Clinical academics have been central to the development of tertiary referral services and a major trauma centre. This has helped to create an excellent district and regional hospital with outcomes that are among the best in the country. Currently our priorities include improving prevention and early diagnosis of diseases, so that fewer patients need hospital services."

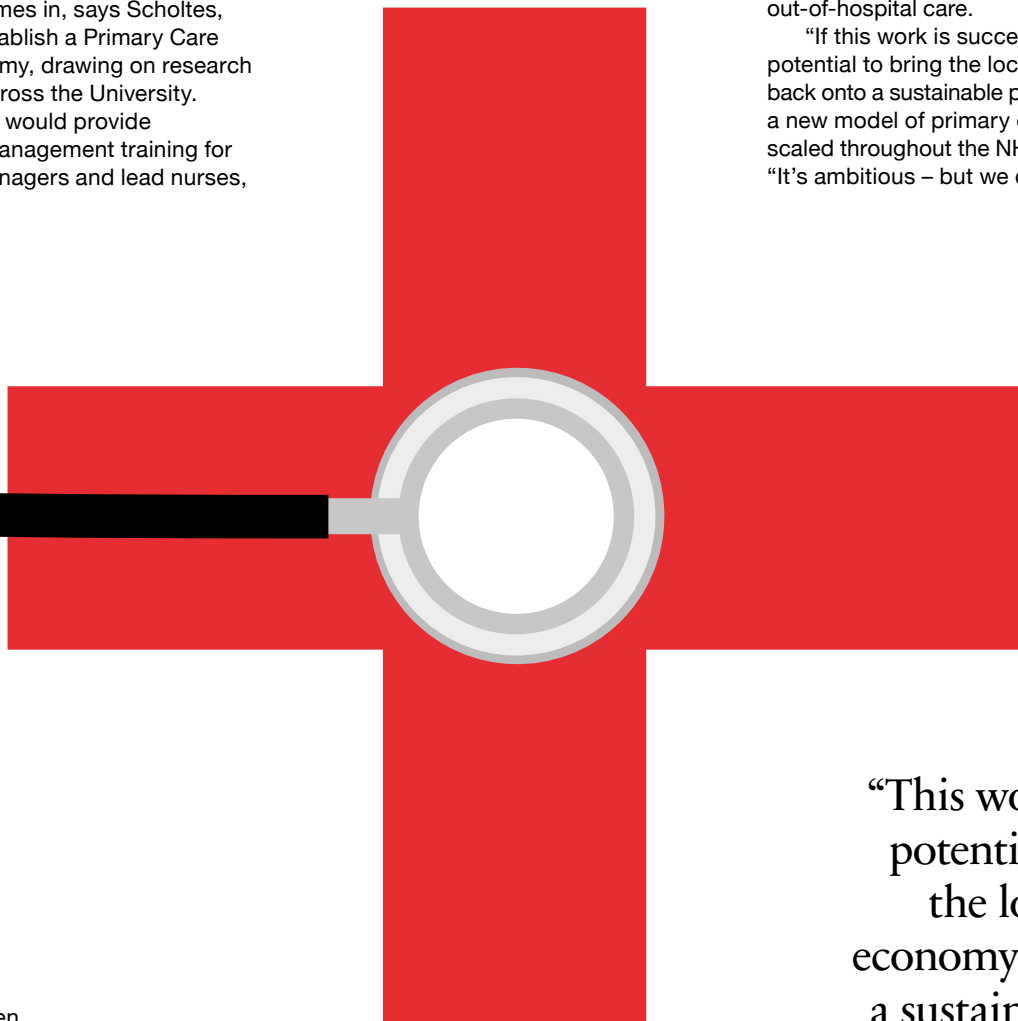
Meanwhile, in January 2019, the NHS released its new 10-year plan, which

In brief	
What	National Health Service
Where	Cambridgeshire, Ely, Peterborough
Who	Cambridge Judge Business School, Dept of Engineering, Cambridgeshire and Peterborough NHS Foundation Trust, The Healthcare Improvement Studies Institute, Addenbrooke's Hospital, Granta Medical Practices

included aims to boost 'out-of-hospital' care through increased investment in primary medical and community health services.

All in all, Scholtes believes that, by the time the NHS reaches its 80th birthday, it could look radically different: hospitals could be doing 60% of what they do now by focusing on cases that can only be treated in hospital and on cutting-edge treatments and research, while more integrated, scaled-up primary care practices will be taking full responsibility for out-of-hospital care.

"If this work is successful, it has the potential to bring the local health economy back onto a sustainable path by establishing a new model of primary care that can be scaled throughout the NHS," he concludes. "It's ambitious – but we can do it."



"This work has the potential to bring the local health economy back onto a sustainable path"





Words
Charis Goodyear



**“The Museum is here to serve
the local community”**

In brief	
What	Education, skills, outreach
Where	Cambridge, Wisbech
Who	Fitzwilliam Museum, Cambridgeshire County Council, Wisbech and Fenland Museum, North Cambridge Child and Family Centre

Inside the Fitzwilliam Museum, the Armoury and Renaissance galleries are alive with the sound of chattering children discovering treasures.

Next, it's down to the art studio, to decorate cardboard treasure chests with patterned papers and metallic markers. Placed inside are precious treasures from a morning spent crafting – in one a handful of sparkling sequins, in another a family of golden teddy bears, carefully cut out with the help of mum and dad.

The children and their parents are participating in *Creative Families*, which is part of *Talking Together in Cambridgeshire*, a literacy project run by Cambridgeshire County Council's Early Years Service. The project is run in partnership with early years practitioners and local organisations, such as the Fitzwilliam Museum and the Wisbech and Fenland Museum, to offer activities that help parents support young children to develop strong communication, language and literacy skills.

Helen Wootton, Early Years Literacy Adviser for the Council, explains: "Across the county we are seeing an unbalanced pattern of achievement at the end of the foundation stage. Any support we can give during these early years will have a real impact on children's achievement at school and later in life."

"For some families, this will be the first time they've visited the Museum," adds Sally McGivern, from the North Cambridge Child and Family Centre, which invites families to participate. "It's a wonderful opportunity to spend time together – learning, exploring, playing and talking."

Research findings from previous projects at the Museum inform the day's activities. The unusual objects on display and the crafting stimulate new interactions between parents and children – both verbal and non-verbal – which help to establish the foundations of literacy development.

"The Museum is here to serve the local community and promote learning," says Nicola Wallis, Museum Educator. "We have a responsibility towards these children. We want to do anything we can to give all children an equal chance when they start school. After all, if we set these children up well, who knows what they may achieve?"



Credit: Nick Saifell



T +44 (0)1223 765 443
E research.horizons@admin.cam.ac.uk
W cam.ac.uk/research
f facebook.com/cambridge.university
t twitter.com/cambridge_uni
y youtube.com/cambridgeuniversity
i instagram.com/cambridgeuniversity

Contact
Research Horizons
University of Cambridge
Office of External Affairs and
Communications
The Old Schools
Trinity Lane
Cambridge
CB2 1TN

Reclaimed from the sea and drained by ditches and rivers, Fenland is one of the most distinctive rural landscapes in the East of England – and has some of the best agricultural land in the UK. Read how Cambridge University researchers are working with farmers and industry across the region to sustainably increase productivity and profitability (p. 32) in this special issue on the East of England.

Detail from *Windy Autumn evening, Corkway Drove*, painted by Norfolk-based artist Fred Ingrams