A playground for new ideas. A place to collaborate. Experiment, explore, create. Spark change. Go disrupt.

REACT Report
2012–2016

REACT

Research & Enterprise in
Arts & Creative Technology

Contents

Section 01
What was REACT?

REACT[1] was a collaboration between UWE Bristol and art and cultural cinema centre Watershed, along with the Universities of Bath, Bristol, Cardiff and Exeter. In 2012 we were awarded £4 million over four years by the Arts and Humanities Research Council (AHRC) to support collaboration between our partner universities and companies active in the creative economy.

We were one of four 'Knowledge Exchange Hubs for the Creative Economy' established by the AHRC to develop new models, methods and approaches to pursue this mission.[2] It was the first time the AHRC had devolved its knowledge exchange budget. Each hub worked in its own way, ensuring that there was a diverse range of approaches to support a substantial volume of creative economy research and development.[3]

REACT's approach was to generate a dynamic network of creative practitioners, academics, businesses and other creative organisations that could innovate together and so make an enhanced impact on the creative economy. We understood this dynamic network as a 'creative hub'. We funded projects in a range of creative markets, from publishing and interactive documentary to creative products designed for children. We also conducted research into what it meant for universities, researchers and creatives to co-produce work in this way.

This report shares our findings, recommendations and reflections on the process of establishing and supporting cross-sector collaboration in a creative hub.

A, B   REACT supported collaborative R&D with a sense of critical exploration and play.

Section 02
REACT in numbers

Between 2012 and 2016, we supported **53** collaborative projects featuring **57** creative companies and **73** academics from the arts and humanities with **£2.5 million** for them to work together on over **25,000** hours of collaborative R&D. They produced **86** new products, **76** new pieces of software, **10** new companies, **43** jobs, **25** academic research articles and

over **90** presentations at research conferences. This stimulated over **£5.35 million** in further investment in our projects, from private investment, sales and commissions, plus additional research grants and **£2.23 million** in internal and external investment in REACT legacy activities. We shared our work with over **7,000** members of the public.

Section O3
Findings

→ Universities can play a pivotal role in the growth of multidisciplinary hubs which enhance innovation and productivity in the creative economy.

→ A creative hub is an insurgent process, a culture change project that challenges the 'business as usual' thinking of all partners.

→ University-led hubs benefit from 'third spaces' that provide an open, accessible and neutral meeting ground, perceived as neither university nor commercial.

→ Creative hubs succeed when they are driven by values rather than output. These values will vary, but may include: enhanced know-how and skills; generosity and mentoring; inspiration and leadership.

→ Productivity in a creative hub (and so raising the value of hub members' individual outputs) arises from the relationships between the people working within the hub's network.

→ Successful networks can produce many different kinds of impact, ranging from start-up firms and new teaching programmes to further research and commercial investment.

→ Arts and Humanities approaches are key to maintaining the human experience at the heart of technological innovation.

A

A REACT was led by a set of values that encouraged thoughtful innovation. One of the projects we supported was *Breathing Stone*, a therapeutic device to help relieve stress and anxiety by generating music in response to a user's heart rate. It was developed by researchers at the University of Bath and startup Adaptive Media. Photo © Max McClure *maxmcclure.com*

"**REACT demonstrated that it's OK to be innovative in theory and practice to generate creative, social and business opportunities for the common good**"

James Richards, Director, Chromatrope

Section O4
Recommendations

We recommend that those institutions and agencies looking to support collaboration between universities and the creative sector should consider the following:

→ Universities can play a leading role in building networks for the creative economy, but equal partnership with organisations in the creative sector is vital. Universities cannot go it alone.

→ Universities should establish long-term relationships with these delivery partners based around 'third spaces' that offer neutral ground for collaboration.

→ Universities should invest in active curation and co-production of networks by developing further the role of creative producers to nurture productive relationships across the creative economy. Creative producers are as critical to success in creative economy knowledge exchange as professional laboratory managers in scientific research.

"Although we were called a 'creative economy hub', REACT was fundamentally a culture change project"
Jon Dovey,
Director, REACT

→ Universities must recognise the shorter financial horizons of SME and micro-business partners, ensuring that researchers are available for agile working, for example, to produce prototypes.

→ Universities' financial transparency should be built into partnerships as a matter of basic practice and good faith. A standard, simple, plain English template should be drawn up for use in all contracts involving external creative business partners.

→ Intellectual Property (IP) exploitation is an important feature of the creative economy, but care should be taken to avoid aggressive position-taking at the early stages of creative collaboration.

→ Creative hub investments by Research Councils, or arts and business development agencies, should have an eye to extended business horizons and long-term relationships. Short-term 'acceleration' models are unlikely to work well in a creative economy context.

→ Creative hub investments should include second stage business and enterprise development, enabling projects to move beyond experimental prototypes. This investment requires partnership with other funders, such as innovation organisations and business development agencies.

→ Creative hubs should recognise and cultivate the values that constitute their communities and develop metrics appropriate to them.

→ The economic challenges of a digitised world require STEAM[4] not STEM approaches. This requires cross-research council investment to produce knowledge and expertise that adds value to the creative economy.

→ The creative economy should feature in all UK regional economic development strategies, drawing upon expertise from universities, businesses and relevant networks.

A   B

A   At REACT we have been committed to sharing our learning and celebrating the successes of the people we work with.

B   Strong collaborations between academics, creatives and audiences are key to innovation. In Play Sandbox, this belief led to the involvement of children directly in the design of products for young people. Photo © Max McClure maxmcclure.com

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4   STEAM (Science, Technology, Engineering, Arts and Maths) advocates for the inclusion of arts and humanities perspectives within STEM (Science, Technology, Engineering and Maths) approaches to innovation, research and education.

Section O5
How Did We Get Here?

What are universities for in the 21st Century? Where once the university libraries or laboratories were the privileged and protected sites of cultural and scientific knowledge, we now live in the age of increasingly open access. In principle, anyone with an internet connection can access most of the world's research knowledge. This, with the pervasive global spread of mobile internet access, means that the barriers of entry to knowledge production and dissemination are coming down.

These new conditions of the production of knowledge are challenging universities to find a new role supporting effective open innovation strategies. This new role will be central to boost the UK's rapidly growing creative economy but it represents a significant challenge for all countries which have entered the post-industrial stage of economic development.

The AHRC's Knowledge Exchange Hubs for the Creative Economy were funded in 2012 at a cost of £16 million 'to work in partnership with creative businesses and cultural organisations to strengthen and diversify their collaborative research activities, build new partnerships in the creative economy and increase the number of arts and humanities researchers engaged in research-based knowledge exchange.[5]'

The challenge for the Arts and Humanities Research Council was, in short, to prove the continuing relevance of their disciplines to the creative economy. Traditional disciplines like English, Drama, Design, and History had always enjoyed close working relationships with the cultural industries, the museum sector, publishing, and the subsidised theatre. Now the entire landscape had been digitally redrawn, 'creativity' was increasingly understood as technological and was positioned at the heart of New Labour industrial policy.[6]

In 2013 the Nesta *Creative Economy Manifesto*[7] directly addressed the policy issues arising from a view of a Creative Economy comprising not only the outputs of the creative industries, but also creative work in other business sectors, for example in design, marketing, communications and branding work in financial services firms or in manufacturing. By focusing upon creative inputs rather than cultural outputs, the report was able to make plausible estimates of the relative size and growth trajectory of the creative economy. It suggested that defined in this way, the UK Creative Economy accounted for 9.7% of UK GVA based on employment of 2.5m people.[8] This makes it a bigger sector than Financial Services at 9.4% and a point smaller than the 10.7% of all manufacturing.[9] However by far the biggest proportion of the Creative Economy comprises microbusinesses and SMEs which are fast moving, dynamic and frequently invisible to institutions at the scale of a university.

"The UK Creative Economy is estimated to produce 9.7% of UK GVA based on employment of 2.5m people. However by far the biggest proportion of the Creative Economy is made up of microbusinesses and SMEs who are fast moving, dynamic and frequently invisible to institutions at the scale of a university"

The widespread changes to knowledge production brought about by search technologies and social media, along with the spread of new relationships of co-production with the people formerly known as consumers, audiences, patients and students, raises serious challenges for universities. In these institutions, most research continues to structure itself around disciplinary fortresses, contested and defended. Academics venture into the unknown realms of interdisciplinarity at their peril. Here, rewards are uncertain and recognition elusive. The Arts and Humanities as a category suffer from an additional crisis of confidence generated by the relentless emphasis (often from Arts-educated leaders) on the exclusive importance of STEM subjects, which are held to confer unique competitive advantages upon individuals and societies which respond appropriately.[10] This crisis is well-represented by the withdrawal of state support to universities for Arts but not Science and Technology students[11] and by the modest size of the research budget allocated to Arts and Humanities subjects.[12]

Given a context of global financial crisis (2008), followed by metered austerity (2010 onwards) and related political/economic crisis in the European Union, the AHRC's Knowledge Exchange Hubs for the Creative Economy were seen as a high stakes investment in demonstrating that Arts and Humanities research has a meaningful offer for innovation in the creative economy. This at a time when economic growth generally was worryingly slow and productivity flat-lining. The Bank of England's Chief Economist, Andrew Haldane, called this the worst productivity block for almost a century, other than in periods involving post-war demobilisation.[13]

These conditions framed the challenges facing REACT. Could we reach out across our partner universities and engage their traditional research communities with new patterns of creative economy? Could we persuade creative businesses, start-ups and innovators that historians, literary scholars and musicologists had something interesting and *productive* to say to them? Could we demonstrate that the Arts and Humanities could make an impact on this changing world?

5   AHRC website: *http://www.ahrc.ac.uk/research/readwatchlisten/filmsandpodcasts/kehubs/*
6   DCMS (2008) *Creative Britain: New Talents for the New Economy London*: DCMS.
    http://webarchive.nationalarchives.gov.uk/+/http://www.culture.gov.uk/images/publications/CEPFeb2008.pdf
7   Bakhshi, H., Hargreaves, I., and Mateos-Garcia, J., (2013). *A manifesto for the creative economy*. London: Nesta, p33.
8   *ibid* p10.
9   BIS. (2012). *Industrial sector analysis. Department for business, innovation and skills*. (BIS Economics Paper No. 18).
    https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/34607/12-1140-industrial-strategy-uk-sector-analysis.pdf
10 For example: *'Education Minister Nicky Morgan Tells Teenagers : Want to keep your options open? Then do science.'* published on November
    10th 2014 in the Independent Online *http://www.independent.co.uk/news/education/education-news/education-secretary-nicky-morgan-
    tells-teenagers-if-you-want-a-job-drop-humanities-9852316.html* accessed 17.05.16
11 Browne, J., (2010). *Securing a sustainable future for higher education: an independent review of higher education funding and student finance*.
    London: Department for Business, Innovation and Skills.
    https://www.gov.uk/government/publications/the-browne-report-higher-education-funding-and-student-finance
12 The AHRC receives only 3.6% (2015/16) of the Science and Research Funding budget
    (BIS 2014 'The allocation of Science and Research Funding 2015/2016)
13 Speech by Andrew Haldane, Chief Economist at Bank of England given to Kenilworth Chamber of Trade Business Breakfast, titled *'Twin Peaks'*
    http://www.bankofengland.co.uk/publications/Documents/speeches/2014/speech764.pdf

A   Increased access to new technologies, peer-to-peer learning and online connectivity is leading to an explosion of creative innovation, from new products to home-made hacks. Photo © Max McClure *maxmcclure.com*
B   New forms of audience interaction on display in Rusty Squid's *Book Hive*, an installation where books respond to the motion of passersby. Photo © Max McClure *maxmcclure.com*
C   Digital interactivity is giving us new ways to explore our past. *Digitising the Dollar Princess*, a collaboration between University of Exeter and Bow Software, sought to create a non-linear historical biography that invited users to create their own stories about the life of historical figures.
D   New objects, including a 3D printed Turkish ney on show at a REACT showcase, showing how innovation doesn't only have to happen on screens.

Section O6
Practising Cultural Ecology

REACT's approach was born out of the work of our lead partner, Watershed. We established ourselves in Pervasive Media Studio (a collaboration between Watershed, UWE Bristol and University of Bristol), the R&D hub that houses artists, academics, engineers, designers and producers, and began to draw together a wider network of collaborators.

Watershed and its university partners had developed a particular approach to understanding how cultural organisations make a difference to the creative economy.[14] For more than ten years[15] we have become familiar with the idea of 'cultural ecology' used to describe the complex system of relationships and interdependencies that underpin creative productivity. REACT has been a research experiment in attempting to practise cultural ecology, not just use it as a metaphor: in this section of the report and the next we explain the theory and practice of this approach.

This approach, we argue, can enable cultural organisations and creative businesses to understand themselves and it can transform the way they operate by concentrating on the rich mix of values that are released in cultural and creative production. This makes it possible for us all to value many different outputs of the systems we manage: social, cultural and economic.

This approach is challenging for universities. Strongly territorial, competitive and internally buttressed by disciplinary silos, universities are not always promising sites for radical new routes to enhanced productivity. Practising cultural ecology means thinking systematically. Rather than striving to control the system we have to work with its own dynamics to do what we can to support the emergence of creative innovation. Rather than only concentrating on the delivery of each project or programme it suggests we also understand the organism of our operations holistically. This requires concentration upon the quality of the relationships between the creative people who determine the success or failure of organisations.

This new hub was thus formed in the nest of an existing hub, itself initiated in 1982, when Watershed opened in Bristol, declaring itself 'Britain's first media centre.' Watershed subsequently established its first higher education partnership with UWE Bristol (2008), followed in 2010 by a further partnership with the University of Bristol, along with a series of long-standing pivotal business collaborations including Hewlett Packard. Today, Watershed summarises its generative mission in the local area as follows:

'By playing the 'connector' role Watershed has developed to be a public facing cultural and creative economy hub for the Bristol city region with strong networks amplified through

"Underpinning REACT was a system designed to produce high levels of connectivity between participants. This network of agile connections will be the lasting legacy of the REACT Hub"

the cultural programme. It is the open cultural approach combined with wide public engagement and a strong showcasing ethos which has enabled Watershed to leverage its arts profile to become a trusted connector for the Bristol city region.'[16]

It is important to register this abbreviated history in order to understand the depth of the foundations upon which REACT has been built and so to understand the manner in which REACT's university partners outside Bristol (in Bath, Cardiff and Exeter) have been able to establish, re-imagine or scale up their own creative economy hubs, learning from the Watershed model, but also challenging, extending and adapting its approach. In drawing conclusions about REACT's work and answering the question about what might come next, it is essential to note that creative economy hubs as an idea have historical roots stretching back at least 30 years. Creative hubs are part of a long game, and they will not work as randomly spaced short-term projects.
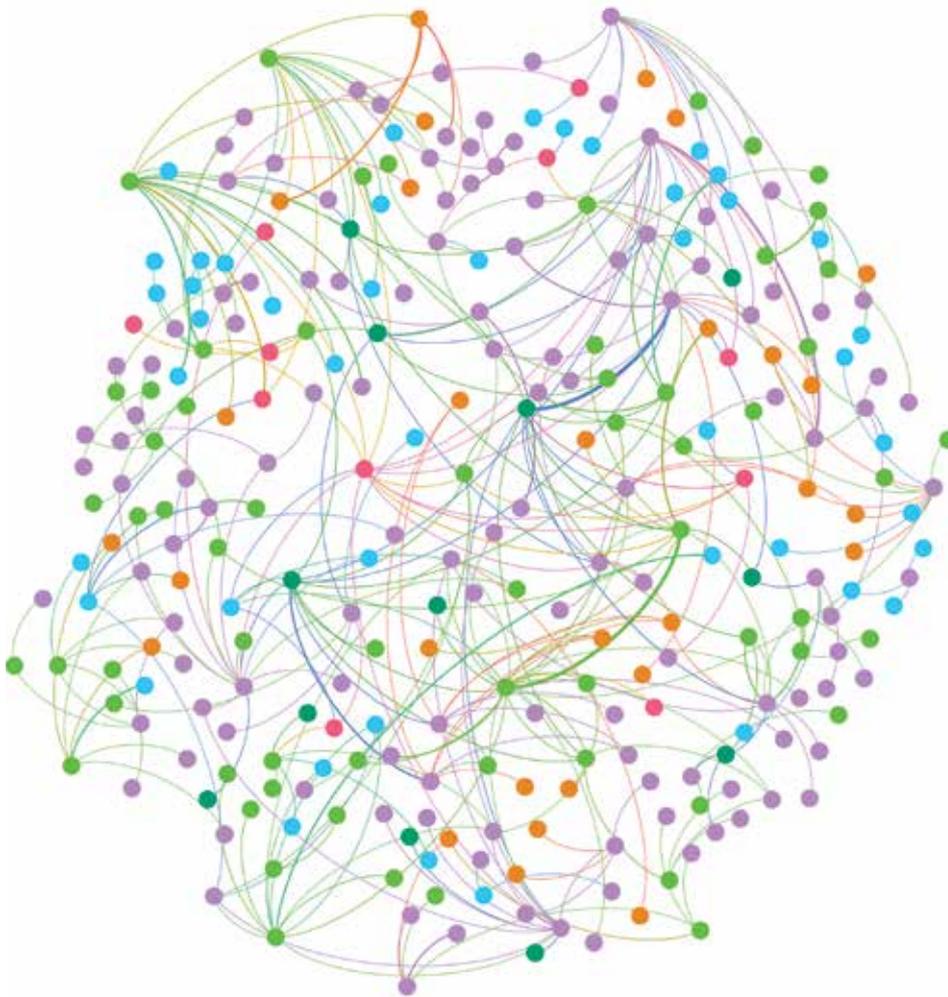
A visualisation of REACT's network, showing how a sample of our participants connected to one another.

- Creative partners
- Academic partners
- Mentors
- Producers
- REACT team
- Other participants

Rethinking the creative microbusiness sector

Developing this practice of cultural ecology is an effective way of supporting the microbusinesses that constitute the bulk of the creative economy. Often small and fragile, these creative microbusinesses are the lifeblood of a regional or city based creative economy. By understanding their significance and their culture we are able to aggregate small businesses into a cohort and then into a network that offers stability and growth through increased connections, opportunities and access to resources.

14 Sharpe, B. (2010). *Producing the future: understanding Watershed's role in ecosystems of cultural innovation.* Retrieved June 6, 2012,
       from *http://www.internationalfuturesforum.com/publications* (Under Enterprise) and Bachmann, G, Dovey, J, Monaco, J, and Sharpe B
       (2012) Cultural Value Networks, Digital Cultures Research Centre, UWE Bristol,
       http://www.dcrc.org.uk/wp-content/uploads/2013/08/valuefinalreport_0.pdf
15 Holden, J. (2004). *Capturing cultural value.* London: Demos.
16 Watershed website - *http://www.watershed.co.uk/about/about-us*

Creative microbusinesses are frequently dismissed as 'lifestyle' businesses because they don't fit the conventional high-tech high-growth model. We turned this perception around and argued that these businesses constitute the creative labour force for future productivity and a pool of talent. To realise their potential we have to cultivate deep knowledge and understanding of their creative milieu.

If we ask creative workers what motivates them and what values they hold dear we get a wide range of answers[17] - inspiration, trust, support, excitement, virtuosity, discovery, reputation. What happens in the production of any creative product or service, is that values of this kind are in play, being shared, swapped, exchanged and built upon.

Sharing, collaboration and trust have always been at the heart of creative and cultural production. Staging a play, making a TV show or a computer game all involve teams of creative specialists working together. Today's creative economy demands an intensification of this collaborative spirit. Creative innovation now calls upon an unprecedentedly wide range of skill-sets and backgrounds; designers, artists, psychologists, engineers, computer scientists, financial modellers: all could be routinely deployed in any creative innovation involving digital technologies and human users. Furthermore, addressing some of the worlds' intractable challenges like climate change, ageing populations, inequality and security also turn out to demand powerful new forms of interdisciplinary co-operation.

Crowding diversity

An important principle for REACT has been to develop an ecosystem based on 'crowding diversity' of expertise, that is to bring together different kinds of people with different kinds of skill-sets, approaches, values and professions, and see what kinds of creative sparks fly when they work together.

In REACT we mobilised 25 different research disciplines, and an equally wide range of creative industry partners.

Every partner in a REACT collaboration brought their own values and motivations: historians, linguists, musicians, interaction designers, engineers; they all have different ways of understanding the world. The *essential* feature of the practice of cultural ecology is how all those different approaches are curated, managed, and nurtured. In our system it is the job of the creative producer (supplemented by advisors and mentors) to 'catch the sparks that fly' in interdisciplinary collisions, and to ensure that they grow into a healthy creative blaze. Producing a creative and productive ecosystem is an active, dynamic process.

As a complex network an ecosystem has unpredictable and emergent effects. Academics who arrived at the process not sure exactly what to expect produced not only the project prototype, but also new relationships for other research projects, with new academics from other universities and new relationships with creative companies for deployment on other projects. Creative businesses left not only with a prototype but with an expanded skill base, new knowledge from other creatives and an understanding of how to work with academic research.

Underpinning this activity was a system designed to produce high levels of connectivity between participants. This network of agile connectivity will be the lasting legacy of the REACT Hub. However, as we have seen, this network of relationships is the product of longstanding institutional partnerships and relationships which set the conditions for the ecosystem to thrive.

A,B Crowding complementary skills and user-testing are are essential ingredients for making new products and experiences. Photo © Max McClure *maxmcclure.com*

17 Arvidsson, A, Peitersen, N (2016) *The Ethical Economy: Rebuilding Value after the Crisis,* Columbia University Press: New York.

Anthropology. Animation. **Applied and Fine Arts.** Archaeology. **Architecture.** Business Studies. **Community Development.** Computer Science. **Design.** Digital Media. **Drama and Theatre.** Education. **Electrical Engineering.** Film. **Games Studies.** Geography. **History.** Interactive Arts. **Journalism, Media and Cultural Studies.** Literature. **Music.** Product Design. **Photography.** Sociology. **Theatre and Performance Studies.** Games Design. **Heritage Interpretation.** Mobile and App Design. **Experience Design.** Documentary Production. **Creative Writers.** Sonic Arts. **Choreography.** Placed Based Experience Designers. **User Experience Consultants.** Biodata Software. **Creative Consultants.** Industrial Product Design. **Interactive Lighting Design.** Social Design. **Robotics.** Interactive Theatre. **Publishing and Design.** Web Development. **Digital Creative Agency.** Animation. **Theatre.** Film and Video Production. **Musician.** Electronic Musical Instrument Design. **Psychology.**

Case Study

Ben Gwachmai on REACT
–
Managing Editor,
Book Kernel, a startup
supported by REACT

"I've always maintained that humans are not ants: we can be and do many things. So long as we're open to it, we'll do incredible things."

Yet had you told me three years ago that I'd win four awards, be paid to travel to New York, produce one of the National Trust's most innovative projects, curate an exhibition for a festival about death, help create participatory soundtracks for cities, work with cutting edge technologies, and build a strong community of friends and collaborators before I was 30…I'd probably have been understandably bemused. Then sceptical.

But that's what happened.

In late 2012, I was at a low. I'd broken up with my girlfriend, I'd had to part with my savings, and I was sleeping in the cold, damp basement of a friend in Bristol in order to find some work – any work – that might sustain me. I was cynical about the future.

However, one collaboration soon led to another…and another.

I went from a small project for National Theatre Wales to being a producer for Book Kernel in the REACT Books and Print Sandbox in no time. I was introduced to a whole new network of people and ideas – on my first day, I felt like a child plunged into the deep end. Reader, I swam. Quickly.

The punctuation "//" is used by coders to leave a message for others reading the code – a footnote, of sorts. I didn't know that three years ago, yet it has formed my thinking ever since.

I use it to indicate a knock-on effect or juxtaposition; in the world of collaboration, they're everywhere: my first REACT drinks, met James Wheale // formed a project called Fabler, Fabler won an award // met Anthony Mandal // we're Gothic Literature fans so Anthony asked me to curate an exhibition from the archive he's working on // Sandbox workshop, met Duncan Speakman and Tom Abba // now help create soundtracks for cities with Circumstance // through James, met Rosie Poebright // played, imagined, worked on A Knights Tale for The National Trust // learned game design, design thinking // used innovative tech // new tech, new thinking // met David Drake // became Dylan Thomas in Bedazzled: A Welshman in New York for the Dylan Thomas 100 Celebrations // went to New York through that.

These are the mechanisms by which we grow.

Networks expanded, contracted – it was all, every bit of it, exhilarating. Sometimes tiring, always fascinating. That's what it feels like to build something new in a new network of collaborators. It feels like being renewed.

Since working in the Wild Wild [South] West, I've embraced my portfolio career. Yet I was, am, and will always be: a writer. All writing is an encoding; all language, a magic.

If, as Heraclitus had it, "*You cannot step twice into the same river*", "//" ensures you cannot read the same sentence twice. Nor the same person. I was once a web designer. Soon I'll begin lecturing on a Creative Media Design BA. I am now, definitely but not definitively, a maker // worker // writer.

I've worked with many teams, learned many things. It's wise to know we'll change. After all, "*They that love wisdom must be acquainted with very many things indeed.*" – Heraclitus. [Yes, him again.]

Ben Gwalchmai is Managing Editor of Book Kernel.
His novel, Purefinder, is available at all good book stores. *@BenGwalchmai*

A

A Innovation through collaboration: *These Pages Fall Like Ash* is one story told across two books. One is a beautiful, crafted physical artefact, the other a digital text on hard drives hidden across a real city and read on your mobile device. It was made by Circumstance and Tom Abba (UWE Bristol) as part of Books & Print Sandbox. Photo © Circumstance.

"**It is no exaggeration to say that in five months Books and Print Sandbox has delivered as much as some mainstream publishers have done in five years.**"

George Walkley, Head of Digital at Hachette
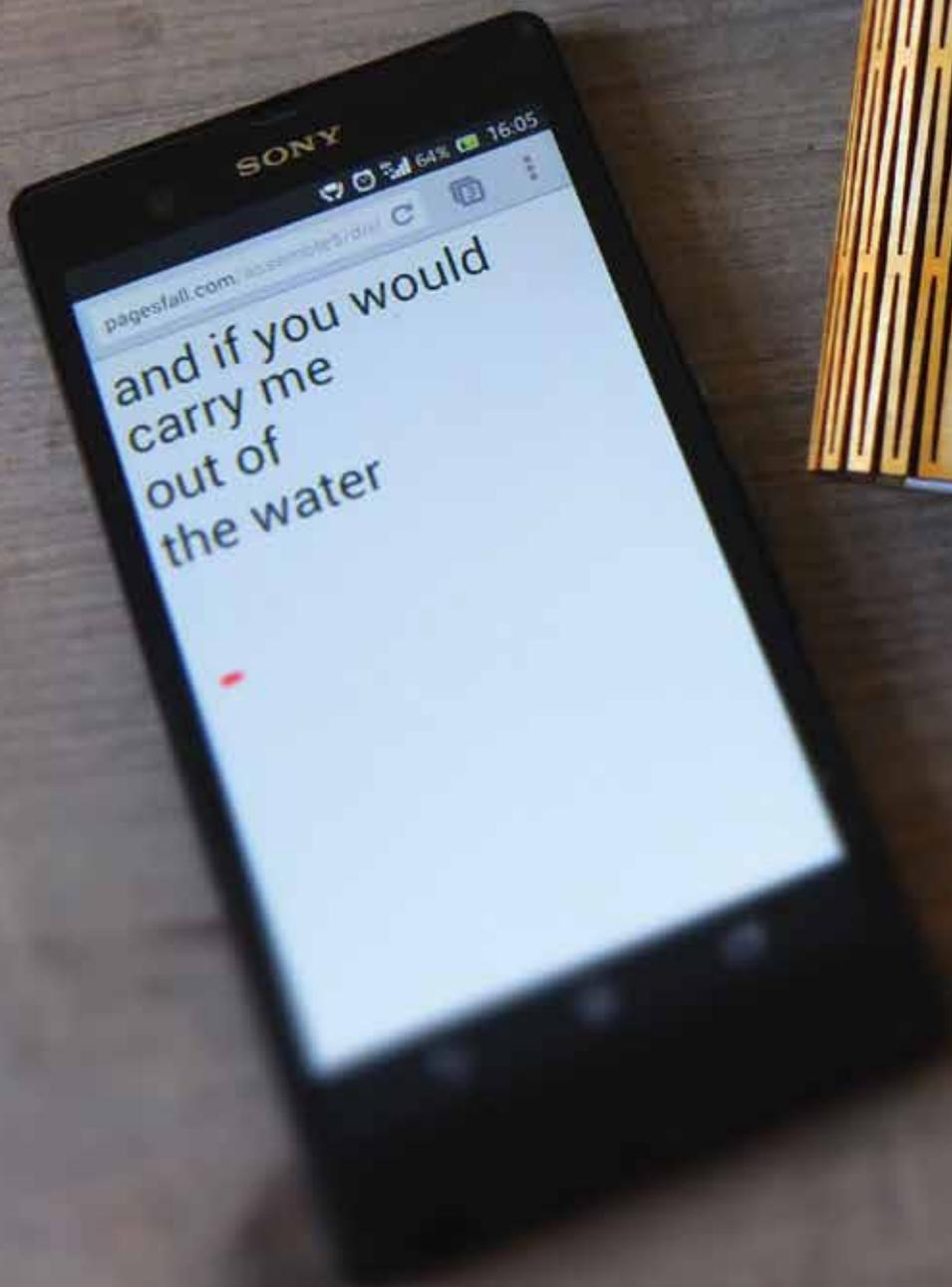
Section 07
Collaboration Through Exchange

REACT did not enter a field empty of university—industry practice. There were already many existing models of collaboration, including those based on tech-transfer models, where patentable items were exchanged between universities and established businesses (materials, components, industrial processes, systems or other products). This wasn't the case in the arts and humanities, where the production of cultural products and services aimed at creating different kinds of experience for audiences and users. As Crossick[18] described it, the arts and humanities needed to support 'knowledge exchange without widgets'.

Despite his argument 'knowledge transfer' has remained the dominant framework for understanding universities' impact upon industry. In these transitive models, knowledge was something that could be moved via a specific transaction. Funding programmes in this field were themselves frequently transactional. Innovation voucher schemes, such as those trialled by TSB[19] and other forms of 'buying out' of time, frequently led to funded partners being left to their own devices in what often turned out to be short-term collaborations.[20]

A different approach was needed.

"We believe that the success of a creative network is based on a recognition that it is values driven, rather than output driven."

REACT Sandbox

Our primary method for supporting our projects was the REACT Sandbox, adapted from Watershed's existing Sandbox[21] methodology and delivered by a team of Watershed Creative Producers, dedicated to REACT projects. We also delivered smaller schemes, such as our Feasibility and Prototype Funds, and offered follow-on support for on-going collaborations through our Alumni Scheme.

We ran five calls for funding, each with its own theme. These explored Heritage, Books and Print, Future Documentary, Internet-connected Objects and Play. Each theme was generated in consultation with creative economy advisors. They appealed to those sectors most in need of research and development to respond to the disruptions of technological innovation.

Each theme held Ideas Labs across our region, day-long sessions where creative businesses and researchers were brought together to meet and generate initial ideas and contacts. These ideas were then developed by university teams and REACT producers to bid for REACT investment. Funding decisions were made by

the REACT Operations Group representing all the university partners and advisors from our creative business network.

For each theme, a cohort of projects was chosen that represented a diverse range of skills, approaches and knowledges. Each team was led by one academic and one creative business. Successful project teams were awarded between £10k and £50k, dependent on funding stream. In a Sandbox, £10k went towards the company's investment in the project (most often their time) and the remaining £40k was spent on academic time, university costs, travel, materials and other project resources such as prototyping, manufacture and testing, or subcontracting additional expertise. Creative companies retained all IP produced during REACT.

In each theme, six to eight teams were supported through a programme of workshops, events, and business development meetings, to develop prototype products or services. The whole process was co-ordinated by a Creative Producer with a supporting team of industry advisors, a specialist business mentor, PR and legal coaching.

Each project participated in a public showcase within two months of the end of the programme and each Sandbox project had its own five minute film as a promotional tool. Projects were also supported in applying to next stage funding and investment by the producer team where appropriate.

To find out more visit *http://react-hub.org/*

The REACT method is based on the conviction that collaboration should lead to the co-production of knowledge and ideas, not simply their exchange. Working in an Arts and Humanities context, we believed that we would achieve better results by avoiding merely transactional relationships. We also knew that for many people associated with REACT, this was new terrain.

We recognised that all project teams would need to be supported. Time and money would be available to enable collaborators to work together. Space and outside expertise, relevant not only to their project but also their point in the production cycle, was made available. A network of peer-support across a cohort of projects, united by a theme, was encouraged so skills could be shared, ideas shaped, and solutions to challenges uncovered.

Each cohort also provided valuable feedback to REACT on how to manage and support a network, allowing for a constant feedback loop that enabled us to continue to develop our approaches so that they were suitable for our network.

However, without the expertise of brokers or sustained and long-term relationships with the people in our network, participants and institutions would revert to old ways very quickly, and practitioners would be stuck in their academic and creative silos. This confirmed the role of the Creative Producer as a core component of our methodology. As the case study which follows demonstrates, the producer acts as a creative, administrative, diplomatic and brokering force holding the collaborations together, whilst also helping to develop levels of ambition in terms of markets, products and creative practices.

A,B Debate, sharing, play and a sense of collective enquiry are all central to good innovation.

18 Crossick, G. (2006). *Knowledge transfer without widgets: the challenge of the creative economy.* Goldsmiths: Royal Society of Arts in Leeds.
19 Miles, I., Cunningham, P. (2006). *Smart Innovation–Supporting the Monitoring and Evaluation of Innovation Programmes.* European Commission Brussels.
20 Virani, T.E., (2014). *Mechanisms of collaboration between creative small, medium and micro-sized enterprises and higher education institutions: reflections on the Creativeworks London creative voucher scheme.* Creativeworks London working paper series, 4, pp 1–25. *http://www.creativeworkslondon.org.uk/wp-content/uploads/2013/11/PWK-Working-Paper-4-SEO.pdf*
21 For more information about Watershed and Sandbox, see: *http://www.watershed.co.uk/about/publications*

Values and Practices

We believe that the success of a creative network arises from values rather than outputs. Our values, noted below, emerged from our local context and informed the design of our methods.

Risk
Take creative risks with the projects you fund, and the way you do it. Risk taking at the centre of a network gives permission to its members to take their own risks. It also means on a programme-wide basis accepting failure or modest performance in return for a few powerful successes.

Diversity
Curate a range of participants in a network. We frequently selected cohorts based on complementarity of skills, expertise and background, rather than similarity.

Generosity
Be generous so that ideas and expertise can be shared to realise their maximum value. Projects learn as much from each other as they do from formal inputs to their process. We started each Sandbox with a shared dinner for all the participants, producers and advisors.

Practice
Make practice-led research and development the heart of the process. The principle of learning-through-making keeps ideas flowing. Thinking through doing makes collaboration concrete.

Speed
Making things fast: iteration, the making and remaking of ideas, has been central to how REACT people and projects develop. Physical design processes, paper testing, being willing to throw things away that don't work. These are all processes that we have borrowed from software development.

Community
Foster a joint sense of ownership of the network and all its outputs for all the people in it.

Care
Caring for people is at the core of REACT's method. Care builds trust, facilitates collaboration, and ensures goodwill and positivity. It also builds stronger collaborative teams that are more likely to persist and succeed in their ambitions.

A
B

A,B   REACT's programme brought together a range of thinkers, makers and users to develop ideas. Photo B credit © James Richards.

Applying these values yielded five key practices that might guide other hubs, producers or agencies trying to manage creative collaboration between academic researchers and creative businesses.[22]

We are not who you think we are

Creative potential doesn't reside in a job description. Professional identities have a strong hold in shaping how participants approach collaborations and what they expect to be contributing. Training and experience in a particular background, such as in academia, or creative industries, leads to distinctive professional identity. But what is exhilarating in collaboration is the reconfiguration, contestation and performance of these identities to produce a way of working that is not always possible solely in the worlds of business or academia. Successful collaborations are built on fluid professional identities that extend far beyond received wisdom about Knowledge Exchange where academics bring 'content' in the form of academic research and creative businesses operate as a 'delivery' service that deploys finance and technology to deliver that content to market.

Hold a safe space

Successful collaborations occur in a setting that gives both time and opportunity to work together; this is constituted as a protected space in which mentorship, advice and expertise are available. Quality of attentions is a key part of the REACT methodology. High quality inputs, one-to-one attention and varied inputs all contribute to the provision of a high quality space.

Collaboration is a journey

Collaboration, especially rapid collaboration, is an emotional process. Collaborative work is a journey that involves a series of challenges and interactions that build trust. This is not always an easy process, it does not always work, and some projects will break along the way. Many of our collaborations followed similar developmental arcs, from enthusiasm to challenge and difficulty in the middle of the period leading to resolution in time for the showcase event. The outcome of that journey might not always be apparent during the process; it may take false turns and not make sense until the end.

Curate people as much as projects

In every investment decision we asked 'Does this relationship actually work? Do these potential partners excite and inspire one another? Can they listen to one another?' The space offered by collaborative work cultivates embodied skills and personal dispositions; it acknowledges emotions. It is important not to assume specific approaches of participants based on their institutional or disciplinary affiliation. This might involve assumptions about how individuals will work, what they will do, or how they may contribute. It is just as important that partners have a positive, professional and respectful relationship.

Become a reflexive network

Although we have stressed the importance of designing networks, we recognise that this is not a 'neutral process'. Those charged with organising the network should recognise that they bring to it their own assumptions and way of doing things. We found that what worked in Bristol would not necessarily be appropriate in Bath, Cardiff or Exeter. Organisational self-awareness is important in order to understand the consequences of methods, and to make sure the methods can adapt where necessary.

C
D

C,D   REACT's programme brought together a range of thinkers, makers and users to develop ideas.

22   Moreton, S. and Dovey, J., 2013. *Curating collaboration: the experience of collaborative innovation in REACT* (working paper). Available online: *http://www.react-hub.org.uk/publications/publications/curating-collaboration*

Case Study

Producing Sandbox
–
Jo Lansdowne
Watershed - Lead Producer
REACT

The role of the Producer in REACT has been key to our research and development methodology. Watershed is an organisation interested in cultivating producers with the ability to negotiate complexity, orchestrate the creative process and support an appropriate balance between making meaning and making money. Collaboration between the academic and creative sectors, and the process of innovation itself needs these skills to satisfy the motivations and ambitions at play. The producers in REACT acted to translate, facilitate, challenge and care for the project teams in order to yield greater results for all participants.

Producers in REACT took an active role in brokering collaborations, paying attention both to the stated expertise and ambitions of the potential partners, but also to their individual characters and compatibility. The producer was then an active participant in the relationship throughout the process. Getting their hands dirty with contract negotiation, money flow and identifying potential conflict was a vital part of maintaining an equal and productive team dynamic. There was an emotional journey that Sandbox participants went through, and a rhythm to R&D according to which the producer aimed to shepherd projects through, with well-timed interventions. The producer's role was to care for the participants, champion their progress but also to remind them of where the innovation lay in their project – to steer them back to the path of greatest reward when an easier route felt tempting.

The producer nurtured a sense of collective enquiry among projects. This developed a sense of community and a permissive environment so that the cohort developed its own momentum; intensifying the research potential, sharing capacity among small companies and galvanising industry attention. In order to achieve this, the producer made the skills, experience and talent in the projects visible and curated useful connections across the teams. Producers catalysed on-going conversation across and between workshops by identifying emergent themes and asking pertinent questions. Each workshop ended with a drink in the Watershed bar where these conversations continued in a relaxed environment.

Producers made themselves available to individual projects as a priority, taking responsibility in the project and supporting them to get things done. Project teams had regular meetings with REACT's business advisor Mark Leaver, who acted as the 'commercial conscience' of Sandbox. The producer used these meetings to identify shared needs across the teams, and both programmed workshops (e.g. audience mapping, storytelling, PR and business planning) and seeded conversations with industry advisors (e.g. software, publishing, design, TV, animation, news media, museums) in response. As the community around REACT and the Pervasive Media Studio grew, so did the opportunities for these connections.

The producer took an editorial role in sharing the insights of the cohort more widely, and equipped the extended network to do the same. Projects blogged regularly (promoted through their own networks), and the producer wrote a weekly digest of their own observations. In this way Sandbox amplified the voices of its participants. The producer held the story (liaising with a PR company for press pick up), advocated for the project's work and stimulated a conversation which fed in to their process of iterative design. Importantly the producer was a champion for Sandbox participants; celebrating their successes and creating a positive atmosphere in which it was easier to take risks.

Producing REACT was relational at its heart, and these foundations have ensured that outcomes from the process have continued to emerge, attracting investment and attention far beyond the boundaries of the funding.

A   Producers help collaborations interrogate and test their ideas.
B   Supporting conversations and the sharing of ideas with generosity was a key REACT principle.

"**Producers have a role across the collaboration, from the development of intellectual themes, to supporting a team's development from bid, to project completion, and beyond.**"

Jo Lansdowne, REACT Managing Producer

Section 08
Multiple Values, Many Impacts

REACT, as we have seen, set out to make a visible impact on the creative economy of the West of England and South East Wales. But our definition of impact was much wider than usually implied in the world of higher education. Our work prompted change of many kinds - change within university cultures and procedures; changes in business methods and changes in the horizons of the many individuals from a great range of backgrounds, who worked together. All these changes involve impact.

In the Higher Education sector, impact carries a narrower meaning. In 2014, researchers at all universities in the UK were asked to submit Impact Case Studies to the Research Excellence Framework (REF), a national audit carried out in England by the Higher Education Funding Council for England (HEFCE). This audit had a direct impact on levels of funding received by universities, and on the career trajectory of individual researchers. In the REF model of impact the process takes as its starting point an underlying piece of research, demonstrated in outputs such as peer-reviewed journals or books. Impact is then tracked from this piece of research, to see how it has influenced innovation, policy, the economy or other behaviours in the world outside the university.

REACT collaborations included underlying academic research, but it was rarely understood as stemming from one particular publication. Instead, the expertise of all partners was respected and shared, in a way that aimed not to privilege one participant's professional background over another's. These backgrounds could be based on disciplinary knowledge or approaches, but they could also rest upon professional skills and methods developed as part of creative and business practice. This means that untangling the 'knowledge' within collaborations is difficult, especially when you consider that REACT project outcomes seldom followed sequentially from a given starting point. Rather, via the networks of people and ideas, outcomes, both anticipated and unanticipated, appear in a non-linear pattern.

At REACT we understood impact as an indicator of what changed in the world as a result of being involved in the hub. Co-production, and the spaces and networks in which it unfolds, creates many unanticipated forms of value.

"Our story of impact comes from the idea that coproduction, and the spaces and networks in which it unfolds, creates many unanticipated forms of value."

Ten Kinds of impact

O1 Changes for business partners in their stability, ambition and confidence
£2.86 million received in further investment across 19 REACT companies. The investment includes a mixture of public and private project commissions (*Nth Screen*: Matter2Media /UWE Bristol), Venture and Angel investment (Reach Robotics/UWE Bristol and Sensible Object/University of Bath), industry awards (Chaka Studios/University of Bristol, Rubber Republic/University of Exeter), product sales (*Colourstory*: Arthur Buxton/UWE Bristol, *Mayfly*: Stand and Stare/University of Bristol), innovation funding (Enabling Play/ University of Bath), and third or public sector commissions (Calvium/UWE Bristol, Splash and Ripple/UWE Bristol). This investment has secured jobs, helped products and ideas on their way to market, and supported individuals and groups to grow.

O2 The creation of new businesses
10 new businesses were founded as a consequence of being involved in REACT, which led to the direct creation of 43 jobs.

O3 Changes in market sectors
Our interventions within specific sectors have provided a chance for innovation and experimentation to unfold where larger firms previously had been unwilling to take the necessary risks. We have taken part in activities central to entire business sectors, for example via panels at SXSW Digital in Austin, Texas in 2013 and 2015, and in a showcase and workshops with the children's media sector at the Children's Media Conference in Sheffield. At the Sheffield DocFest, we pushed the form of interactive Documentary. We have written industry briefing notes aimed at boosting innovation in the publishing sector. We received media coverage in over 150 articles across industry and popular press including *Wired, The Guardian, Times Higher Education supplement, Techspark, the Bookseller, Huffington Post,* and *New Statesman*.

O4 Developing new markets for businesses by bringing deep knowledge of human subjects as users of products and services to businesses
Arts and Humanities researchers often specialise in understanding the way audiences respond to cultural experience; this means they have valuable knowledge about audience behaviours. Within the REACT programme, Reach Robotics report that their understanding of the market for programmable robot toys was changed by their engagement with UWE Bristol games researchers, which helped them understand the improvisational nature of children's fantasy play. Reach Robotics went on to secure over £1 millon of investment.

O5 Impact on users of products and services themselves
Many of the projects REACT supported engaged directly with external groups and communities. These activities have led to emergent outcomes, such as the case of *The Quipu Project* (Chaka Studios/University of Bristol) which facilitated Peruvian women finding a voice to tell the hidden stories of their forced sterilisation. Cardiff University's Centre for Community Journalism, launched during the life of REACT, also gained important insights about the technology dimensions of hyperlocal news systems.

O6 The creation of new networks through the collaborative process
New connections between people who meet in the REACT process and go on to secure funding, start projects or businesses together, expand the network and lead to new work. We argue that the creation of new networks of productivity itself constitutes an impact.[23]

A Our projects hoped to create impact amongst communities they worked with. *The Quipu Project* used a combination of on-the-ground activism, phonelines, and digital technologies to support victims of mass sterilisation in Peru to share their testimonies.

23 Dovey, J., Moreton, S., Sparke, S. and Sharpe, B. (2016) *The practice of cultural ecology: Network connectivity in the creative economy.* Cultural Trends, 25 (2). pp 87-103

07 Changes to academics' research profile, new presentation invitations, new research publications and the development of new funding bids for research
REACT has stimulated over £2.5 million in successful research bids, emerging from ideas, partnerships and approaches generated during REACT projects. Funders include AHRC, ESRC, and EU SPARK funding, as well as internal investment from partner universities for academic time. REACT academic partners produced 25 peer-reviewed journal articles and made over 90 conference presentations.

08 Academic career development
Despite the fact that researchers initially reported that undertaking impact work was unrecognised in terms of career progression, university researchers involved in REACT projects have identified professional benefits from their involvement. These have included promotion, or new appointments where experience of external creative collaboration has been understood as a positive asset.

09 Changes to academics' teaching practices
The development of new Masters programmes. The work of REACT has informed the development of Innovation courses at University of Bristol, a four year BA Hons/MA course that builds innovation and entrepreneurialism into courses across eleven departments, including Anthropology, Geography and History. New teaching models, such as the new undergraduate module in University of Exeter on 'Contemporary Visual Practices' with lectures from various REACT academics based in Exeter. The REACT project helped inform the development of a new MEng Integrated Design Engineering degree at University of Bath and a new Masters in Creative Production at UWE Bristol.

10 Changes to universities contracting, payment and IP processes
These changes have happened in relation to the many challenges associated with developing models of collaboration fit for smaller businesses. These include model contracts for working with the creative sector, and default agreements for creative partners to retain Intellectual Property.

Culture Change

At an institutional level we knew from the outset that one of our tasks would be to instigate and manage culture change amongst the organisations with which we worked. For REACT, this meant developing new channels to communicate between the creative sectors and universities, and developing new processes to support collaboration. So we spent many hours working with our university partners in Cardiff, Bath, Bristol, Exeter

A   REACT supported cross-sector collaboration to make meaningful products and experiences.
Photo © Max McClure *maxmcclure.com*
B   Changes to the way students are taught was an important impact of REACT's work.
C   Collective exploration of new technologies has had an impact across our participants and their audiences.
Photo © Max McClure *maxmcclure.com*

and UWE Bristol to communicate with research business managers, legal and finance teams. This week by week effort was frequently devoted to getting new contracts accepted, chasing payments, or sorting out Full Economic Costing (fEC) and VAT wrangles. In the end this built new bridges between partner universities and the creative sector, between departments within universities, with other universities, and with contracting and financing departments.

As well as the core REACT team's work in this area, we were successful in helping to set up teams of research staff and academic leads in the partner universities who were then able to work on the inside of partner institutions to publicise our activities, recruit possible participants, develop relationships and where appropriate broker collaborations. All of our partner universities now have experienced creative economy collaborators.

REACT was overseen by a Steering Board consisting of Pro Vice Chancellors for research from the partner universities, together with leading creative economy partner representatives from across our region. This team has created lasting impact by building new bridges for collaboration in the creative economy between universities. Following REACT, 'Digital Living' has been adopted as a key theme for the GW4 partnership (Bristol, Bath, Cardiff and Exeter Universities). This relationship management across all levels of the partner institution, from contracting and finance, through to the most senior levels, was a notable achievement. It allowed us to embed creative economy as a potential point of impact for all the universities within their own localities and regions. This culture change is reflected in legacy investments by partner universities. At the time of writing, the external and internal investment in REACT legacy activities is approximately £2.23 million.

Stories of change

Underpinning all these outcomes are the stories of change for individuals, which add to the momentum for change in institutions. Stories of change are important because they articulate at a fundamental level how the process of change over time leads to new, unexpected outcomes, and to new ways of being in the world.

Processes of change are frequently experienced simultaneously and result in intense narratives of transformation that begin with what one researcher described as the 'rollercoaster' of REACT, consolidating over time into continuing collaboration over a two or three year period. These stories were documented in many hours of interviews conducted with participants.

We have witnessed many remarkable transformations and epiphanies. An archaeological professor setting up a business for historical travel expeditions with private investment. An engineering lecturer becoming 'Embedded Systems Guru' at a bio-data start-up. A history professor becoming a partner in a publishing business (see *Mayfly* case study overleaf). Sometimes even projects that didn't take off in a full-scale REACT sandbox led to other outcomes. DOC360, the Cardiff University / On Par project into 360 degree immersive cinema projection, helped a small media company towards producing the first wrap-around pop music video made in Wales, positioning them at the heart of the VR market at an opportune moment. Arthur Buxton, a print-technician and artist established *Colourstory*, a free platform that lets the public create and share beautiful representations of your life with colour using any set of images. Charlotte Quickenden, a software developer from Devon, embarked upon a REACT journey which took her to Bristol not only to create innovative software but also to develop new physical products with support from a local business incubator. She then returned to Devon to support the growth and management of a Fab Lab, strengthening Exeter's regional creative infrastructure.

These and many other stories like them are at the heart of what we did. Capturing the narratives is vital to showing the value of cross-sector collaborative work. They sit with appropriate metrics to demonstrate the way in which impact is made and the manner in which it unfolds.

"Without REACT, I wouldn't have made some of the most daring projects I've ever made or have the opportunities regionally, and nationally, that I have today."
Ben Gwalchmai, Writer, Actor, Editor, Digital Producer

Case Study

From Art to
Artisan product
–

Mayfly,
Stand + Stare and
University of Bristol

Stand + Stare are a performance company who also make interactive exhibitions and installations for museums, theatres, libraries and festivals. Through involvement with REACT they have forged a new collaboration, developed an innovative new product called *Mayfly* and are on their way to taking it to market. They are an example of what happens when academics and creatives are supported over a long time to collaborate, helped to innovate and inspired to grow their business in new directions.

"REACT has had (and is still having) a huge impact on our work and our future. Support through pump priming, feasibility and now the alumni scheme has helped us to develop our project Mayfly, which will soon be a new company. REACT brought us and Professor Tim Cole together, which has led to us setting up a business together as joint directors, and also working together on another project through the University of Bristol. We are learning a host of new skills, from app and book design to entrepreneurship and understanding retail. We all feel like we are embarking on a new journey and incredibly lucky to have REACT there supporting us and guiding us as we take flight!"
– Lucy and Barney Heywood, Stand + Stare

Stand + Stare's co-directors, Barney Heywood and Lucy Heywood, have been residents at Watershed's Pervasive Media Studio since 2011, where a small grant had allowed them to produce Theatre Jukebox, an interactive installation that uses real objects to trigger audio and video archive material. Their journey with REACT began with a pump-priming grant in 2013, working with Tim Cole, Professor of History at the University of Bristol to develop *Turning the Page*, an installation in Bristol Central Library for the theatre festival, Mayfest. *Turning the Page* used image recognition to trigger audio recordings within a guidebook to China. This project drew on Stand + Stare's approach to installation, which combines documentary or archival material with a narrative emphasis, and digital technology to allow people encountering their work to interact in new ways.

The team felt *Turning the Page* was successful on its own terms, but had limitations regarding portability and scalability. At this point, the collaboration came up with the idea for the *Mayfly Sound Journal* - a travel journal with an accompanying iPhone app that allows you to make sound recordings and embed them in your travel journal. The idea employs the same technology as *Turning the Page*, but within an app to make the installation a scalable, sharable product. This reflects Tim Cole's research interest in travel and tourism and new narrative forms, based on his existing research at the University of Bristol. They were awarded REACT Feasibility funding to develop *Mayfly Sound Journal*. The funding allowed them to run tests using the first demo app with prototype books handmade by Stand + Stare. The team subsequently won support from REACT's Alumni Scheme, working with business accelerator Upstarter.

The team credits REACT for giving them space and time to explore and grow the ideas emerging from their collaboration. As Lucy says, "we had no idea this is what we were working towards" but "getting to think in a way we didn't know we could think" has enabled the team to develop a core business in a wholly new way. Barney describes how collaborating with Tim "injected new energy" and new sets of skills into their work, and Tim describes the experience as a "true collaboration". It has certainly proved durable with the team establishing *Mayfly* as a business in which Stand + Stare and Tim Cole will become equal partners and Co-Directors.

The *Mayfly* example demonstrates how small artistic companies within a network can be supported to diversify their practices and develop new products that are not reducible to standard distinctions between 'commercial' or 'cultural' products. For the team, this is about empowering creativity around memory and stories in other people. Tim says, "for all of us it is a shift [from being storytellers] to a canvas for others to tell their stories". This enables Stand + Stare to become known for a distinct style that can be applied across multiple platforms, exploring the interface between contemporary commercial and artistic work. *Mayfly* has become the mechanism that brings together in a robust business proposition elements of Barney and Lucy's artistic practice: freelance commercial design and community-building learned in theatre.

A A *Mayfly* notebook waiting to be tagged with audio stories. Photo © Max McClure *maxmcclure.com*

B,C A range of *Mayfly's* innovative products. The images are used to associate audio recordings with physical objects, like books and stickers. Photos © Mayfly.

Section 09
Creative Technologies for Arts RδD

The question of technology posed a particular challenge for REACT. As a delivery team we were committed to finding out what role Arts and Humanities researchers have to play in the field of creative technology. Digital communications and design technologies clearly drive the creative economy. However in a post Snowden, Big Data, and rapidly automating world we were also critically aware that not all applications of technology have life enhancing effects. Traditional Arts and Humanities disciplines might find it difficult to place themselves in this landscape.

REACT's response was to identify fields with genuine research needs that could be addressed through delivering a cross-disciplinary STEAM process which involved mobilisation of the creativity and criticality of Arts and Humanities researchers. This meant seeking out the many sectors of the creative economy which faced disruptive challenge, with a view to identifying opportunities for innovation, development and growth.

The particular histories, tastes and skills of the Pervasive Media Studio also had a shaping influence on the technologies REACT recommended for deployment. This involved seeing beyond the superficial idea of 'pervasive media' as media which is everywhere in a mobile-connected, always-on world. In point of fact, pervasive media involves a research field at the intersection of ubiquitous computing[24] and media design. The Studio's broad research and development field has from its inception involved exploration of the benefits and threats generated by the spread of ubiquitous computing systems in everyday life. This has led to a pattern of work and expertise concerned with 'post-screen' based forms of interaction and communication involving physical objects and sensing environments. Object based commissions outnumbered purely screen based forms of interaction in REACT by a ratio of 3:2. We were keen for our teams to explore the physical properties and tangible interactions made available in a world of connected objects.

This could be seen in projects like *trove*, where the expertise of Debbie Watson (University of Bristol) in the field of looked-after children's life stories became part of an elegant repository for childhood memories, created by social designer Chloe Meineck, that allows children to tag audio stories to their most cherished objects. Another collaboration, this time between electronic engineers Paul Leonard and Chris Clarke (University of Bath), composer Joe Hyde, and business partner Adaptive Media, made *Breathing Stone*, a screenless device that generates music according to a user's heart rate to help tackle anxiety.

A   *Fans on Foot* combined research about fan behaviours with geo-location technology to create a watch that alerts the wearer to locations used in the making of Dr Who (Cardiff University, Tarim).

B   *Trove* uses emergent technologies to help looked-after children document their own life stories through cherished objects.

REACT's work has made an important contribution in showing how Arts and Humanities research insights contribute to innovation in this complex and rapidly changing environment.[25] For example:

Objects
Arts and Humanities researchers include experts in the history of material culture, bringing deep knowledge to any company working with the production of communicative objects. What is the history and culture of an artefact? How has its design changed? What are its material qualities? How will human beings respond to novelty and learn whether or not to trust it? Merle Patchett of University of Bristol brought her knowledge of the history of taxidermy to a project with design company Play Nicely, which introduced new kinds of responsive interaction to museum displays.

Criticality
Whilst criticality is frequently understood in terms quite different to innovation our experience has been that the critical attitude brought by academics to business can produce innovation when it becomes understood as a broad desire to make change. When we asked academics what motivated their engagement with REACT, they frequently mentioned the impulse to change something, to improve or ameliorate. Examples include UWE Bristol's Steve Poole, making a critique of heritage interpretation practices, or University of Exeter's Nicola Thomas developing ideas for a non-linear historical biography.

Experience design
Digital technologies have opened up extensive possibilities for the presentation of immersive experiences through games, media effects and other creative techniques. Many if not most Arts and Humanities scholars are experts in understanding some aspect of the nature and history of human experience. This is especially true where academics understand the ways in which audiences make meanings in different cultures and contexts. So, Cardiff University's Anthony Mandal was able to apply his vast knowledge of Gothic literature to suggest story-lines and potential human responses to support the design of the immersive game, *Hyde*. This expertise in audience response, alongside systematically gathered user-experience of games and other digital media products, is a valuable dimension of the innovation mix in developing a wide range of digital media.

Narrative
A foundational awareness of narrative at many levels makes Arts and Humanities researchers good partners for creative projects. From literary scholars to historians, film scholars and musicians, Arts and Humanities scholars share an awareness of the importance of stories in shaping our experience of the world. UWE Bristol historian Steve Poole, for instance brought vital knowledge of narrative history into Splash and Ripple's heritage game for Bath's Holborne Museum.

These examples arise from particular cases and experiences within the REACT programme; they are sketches made during an intense period of exploration, innovation and production. We offer them as examples of a STEAM based knowledge exchange ecology. Deployed in creative hubs across the UK, inputs of this kind would enrich the R&D landscape of the country's creative economy. Without such Arts and Humanities inputs, the UK's creative economy will innovate less and grow more slowly. Nor should we underestimate the collateral damage of failing to harness the insight and vision of Arts and Humanities scholars to broaden our digital, cultural horizons in ways which enrich everyone, beyond the supply and demand for commercial products.

"Anyone involved in the cultural and creative sector finds themselves increasingly involved with the business of experience design for the 'users formerly known as audiences'."

24 Weisser, M (1991) *The Computer for the Twenty-First Century* in Scientific American (September 1991) pp 94 - 110
25 Senior, T. Moreton, S. and Dovey, J. (2015) *The Arts and Humanities in the Internet of Things,* REACT
 http://www.react-hub.org.uk/publications/objects-publications/arts-and-humanities-internet-things

Case Study

The Rooms Festival:
REACT shows its
wow factor
–
Katherine Jewkes
Lead Producer for
'The Rooms'

👁

In November 2015, REACT took over one of the most exciting spaces in Bristol city centre, transforming it into a showcase for the unique products, services and prototypes created by our 53 projects. We offered a playful, immersive celebration of REACT's work, designed to inspire visitors and to offer the region's arts community a transformative set of propositions.

We created 23 installations across a former magistrate's court, fire station and artist studio complex. These ranged from a bedroom where you could explore the future of sex and intimacy, to a library that considered how books and print might be reimagined for the future.

REACT worked with new partners from the South West to make this happen, bringing together the partners at Bridewell Island - the Station, The Island, The Kitchen and The Old Crown Courts - for the first time. We sited the REACT laboratory inside the Victorian Prison Cell system. We created a newsroom in the entrance to the Old Crown Courts and Magistrates Court 3 became our library. We worked closely with the venues to reveal beautiful heritage features, polishing tiles and opening up old fireplaces. The production and organisation brought together crew from across the region; Watershed, National Theatre Wales, Wildworks, The Invisible Circus, The Island, The Station and Shangri-la.

Entry to the event was free, but we did not anticipate that 6,000 people would turn up. Feedback told us visitors experienced a rich, textured and beautiful showcase of research and creativity at its best. "Academic research has never been so cool," said one of our visitors. The academic research themes on show were certainly diverse: death, future books, social activism, sex toys, giant sculptures, teeny cinemas, bio-activated mazes, interactive light swings, den building and toy hacking. The mix appealed to people of all ages. It was a remarkable illustration of the public's thirst for learning, for play and for the exploration of new technology and research.

"Enjoyed visiting #therooms again today. Brilliant creative stuff. 3 Year old daughter did her first toy hack ... Barbie has purple hair now!"
@Mrj1971, Twitter

"This makes me feel nostalgic for times gone by. Books and buildings lost to the past. It also served as a reminder that maybe, just maybe, the future could and can be as beautiful"
Audience Member

"A smorgasbord of amazing experiences at #therooms in Bristol – and the crowd can't get enough!"
@Maireadnc, Twitter
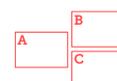
A,B,C Over 6,000 people joined us to explore, experiment, play, and uncover new experiences at the Rooms. Photos © Paul Blakemore.

Section 10
The Future

REACT's experience has validated the thinking behind the AHRC's four-year programme of support for creative economy knowledge exchange hubs. The REACT hub has shown how creative economy activities can be part of the mainstream discussion around issues such as skills, productivity, R&D and infrastructure. This thinking now needs to mainstream policy debate on national, regional and local economic growth. Our key message is that universities have a significant role to play in the creative economy, along with other players, including those which have suffered significant spending cuts such as local authorities. The partnership approach of the 'hub', which can be adapted to local and regional circumstances, is the relevant core methodology.

The choice of the word 'hub,' used by the AHRC to guide the structural approach for each partnership, builds upon a significant and diverse experience of the use of hubs in building cultural and creative economy ecosystems around the world. According to recent research, there are an estimated 300 creative hubs in Europe; of these 7 per cent are university-based,[26] indicating the scope to scale up university impacts on the creative economy. The collaborative dynamics of these hubs have acquired additional momentum in the light of new modes of postindustrial production, supported by the spread of digital communications technologies into art, culture, the creative industries and the wider creative economy. As the British Council has stated: 'worldwide creative hubs are playing an increasingly important role in how creative people and businesses interact, collaborate and socialise'.[27]

The 'hub' has to date involved a multiplicity of forms, but a commonality of purpose in the co-production and co-design of knowledge, goods and services. These practices today are reflected in participatory experiences for arts audiences, museum visitors and gamers, as well as in 'open' government initiatives driving 'e-democracy' and in the application of patients' experience to health authority decisions and student feedback into university course design. The scale and breadth of these developments has been described as a broad-based 'participatory turn'.[28] This phenomenon is also shaping the research, innovation and creativity landscape of the future. We believe that the structure of flexible collaboration supported by a hub can intensify innovation and increase productivity in cities and regions and that the university knowledge and resource base is a key asset in hub design. The creative economy hub is also well suited to deployment in the mechanics of contemporary devolution strategies and regional development in the UK, such as 'City Deals', 'The Midlands Engine' or 'The Northern Powerhouse'.

Working from the fact that the creative economy of the UK accounts for more than 8 per cent of all jobs; that these jobs are among those least likely to be automated out of the

"Worldwide, creative hubs are playing an increasingly important role in how creative people and businesses interact, collaborate and socialise." British Council

human workforce, and that this creative economy is growing, year-on-year, faster than the rest of the economy, policy-makers will be right to include a strong creative economy dimension in their plans for further economic devolution.

This provides the context for university research funding councils and their associated innovation agencies to persist in the long game of supporting the further flourishing of creative economy ecologies, which are themselves the place where Arts and Humanities research reaches across disciplinary boundaries to collaborate with social science, medicine, engineering and science, to illuminate and meet human need and aspiration. Creative economy knowledge exchange hubs like REACT, along with the hubs which sit within the REACT structure, should be seen as basic to the higher education offer of creating social, cultural and economic impact, which is itself an essential feature of an open innovation system driving wider economic success.

Our aspiration is that university Arts and Humanities faculties understand themselves as key parts of their own city wide and regional networks, not only for creative economy success but also for effective innovation strategies across the public, private and third sectors. The REACT collaboration demonstrates how different kinds of universities, cultural partners and creative businesses can together co-create an effective regional intervention, based upon articulating cultural ecology as a practice. The methods and systems we have developed can be scaled up in the future, both in our own region and in other places.

There are, though, no cookie cutter solutions to replicate this success. Each region, each hub and each ecosystem will have different assets, relationships, histories, capabilities and capacities. We have found that for instance Cardiff, Bristol, Bath, and Exeter all have different distinctive assets and aptitudes. Each ecosystem has its own strengths and weaknesses, and we have tried to imagine our own future beyond REACT with a closer grained reading of regional difference (see section 11). The creative economy is at once global but intensely local.

"REACT points towards an alternative future, where a new kind of 'knowledge commons' supports collaboration between universities, business and public institutions in places where new types of productivity are needed"

A

A   Residents at Watershed's Pervasive Media Studio are exploring how digital technology can be used in cultural or commercial settings, spanning play, robotics, location-based media, food, connected objects, interactive documentary and new forms of performance. Photo by Paul Blakemore © Watershed.

26 BOP Consulting - *http://bop.co.uk/articles/europes-creative-hubs*
27 British Council - *http://creativeconomy.britishcouncil.org/projects/hubs/*
28 Facer K., and Enright B (2016) *Creating Living Knowledge: The Connected Communities Programme, community-university relationships and the participatory turn in the production of knowledge*, Bristol: University of Bristol Press/AHRC Connected Communites.

The current creative economy innovation space can sometimes feel like a Wild West: a chaotic and wasteful process, where start-ups come and go and where over-arching national priorities, for example to achieve leadership in digital sub-sectors such as financial services technology (fintech) or branches of artificial intelligence, do not connect with realities on the ground. Great ideas can get lost in the competitive scramble to succeed and short-horizon initiatives by universities can make this situation worse, not better. Microbusinesses collide and shatter in the churn of a competitive landscape. In the meantime, dominant global players – Amazon, Google, eBay, Facebook, – are able to appropriate the value produced through shared information and convert it into speculative stock market valuations. REACT's experience points towards the possibility of an alternative future, where a new kind of 'knowledge commons' supports new levels of collaboration between universities, business and public institutions, often rooted in places where new types of job and a productivity turn are both badly needed.

To deliver the desired economic advance, cities, city regions and other sites of economic regeneration will need to work with universities to establish new forms of organisation and governance to generate value in the creative economy. This should entail exploring emergent legal forms of commons copyright and organisational forms such as the UK's Community Interest Company, or the US led B Corps[29] movement, so that the value produced through the hub's network can be better captured, mobilised and extended. These forms of structural innovation will enable us to address through social innovation some of the exclusion issues visible in today's informal, high tech, mobile and precarious innovation systems.[30]

Our vision is that universities actively seek creative economy partnerships with a view to developing open systems for the creative economy. This would lead to a commons where leading regional players can establish collaborative research and development spaces where researchers from across disciplines work with creatives, designers and start-ups to build enterprises of the future. The 'enterprise' may be social or commercial; what matters is that ideas are geared toward innovation which serves human need.

A   We believe in a bright future for collaborative R&D and its ability to address many of today's economic and social challenges. Photo © Paul Blakemore.
B   Creative Cardiff is a new initiative to connect and support the city's creative sector. Photo © Creative Cardiff.
C   Kaleider's new studio in Exeter will be home to exciting new creative sector/university collaborations. Photo © Kaleider.

29 For more information on Benefit Corporations: *https://www.bcorporation.net/what-are-b-corps/about-b-lab*
30 See Raunig, G., Ray, G., and Wuggenig, U., eds., (2011). *Critique of creativity: precarity, subjectivity and resistance in the 'creative industries'*. London: MayFlyBooks.

Section 11
REACT legacies

Cardiff

Creative Cardiff was established in 2014 with a £1.5m commitment from Cardiff University. During its start-up period the team developed relationships with early and potential founders and funders (BBC Wales, Cardiff City Council and the Wales Millennium Centre) as a first step to establishing a more developed governance and business model in 2016. Creative Cardiff aims to continue the work of REACT in the region by seeking further investment and support.

Creative Cardiff has four strategic goals:

→ Creative Research: new groups and internal/external partnerships aimed at a range of targets, including creative economy mapping and a range of projects with Cardiff creative institutions such as the Swn Music Festival.

→ Creative Cardiff Network: web-based and event-supported peer network, through which creative businesses, organisations and individuals collaborate and innovate and enjoy shared resources, such as contract and job-finding services.

→ Creative Exchange: a physical open collaboration and innovation hub, involving creative business start-ups, freelance, micros, SMEs and larger players alongside students and academics (pilots in summer 2016).

→ Creative identity and profile: a facilitating role with other key players to develop the thinking and execution of a stronger creative identity for the city region.

Exeter

There are multiple REACT legacy trails emerging in Exeter. Plans to co-locate a number of Exeter academics, Arts Council England National Portfolio Organisation Kaleider, associated creative economy partners, and Met Office data staff in a new studio are coming to fruition. Kaleider have expanded their city centre co-working space. They are now welcoming university researchers from Geography and the College of Humanities, who have secured internal funding to drive the university's emerging Exeter Heritage Initiative and Arts, Culture and Creative Economy strategy. The Kaleider studio has the potential to develop a hub with a particular Exeter remit to work with arts and technology addressing climate change and sustainability.

Bath

Bath will continue its collaboration with partners at Bristol, Watershed and Exeter in projects on the internet of things and in robotics, supported by additional funding and resources acquired during, and as a result of, the REACT partnership. REACT has leveraged partnerships for EPSRC and EU grants, such as *Being There: Humans and Robots in the Public Space*, a project which features Danaë Stanton Fraser (University of Bath) as a co-investigator, and Watershed as core partner ensuring public engagement with human-robot interaction research. Elies Dekoninck's success with *Beasts of Balance* was also instrumental to success in a recent EU Horizon 2020 grant on spatial augmented reality in co-creativity. The University of Bath has recently opened a new Centre for the Arts (The Edge) which has benefited from interactions with REACT partners in designing an exciting artists' residency programme.

Bristol

The Bristol based partners are planning a new research network to be established in 2016 that builds on the success of the REACT Hub. Bristol will act as our primary test-bed through which partners will develop a longitudinal understanding of engagement and growth. Within this context we will test new approaches to support inter-disciplinary innovation and to attract diverse participants. This will be complemented by working with national and international partners to develop robust analysis and methodological insights which are transferable to other cities internationally.

Watershed will continue to develop its role as key broker in the regional creative economy network through the further development of the Pervasive Media Studio. The UWE Bristol component for the network will be led by the Digital Cultures Research Centre and the University of Bristol component by the new Brigstow Institute, led by Professor Tim Cole.

The Bristol network will continue to work with the regional cluster to deliver impact through applied research processes but will also aim for global recognition of its models, processes and findings. Our aim is to create a new kind of 'knowledge commons' where open innovation and co-creation drive growth and impact.

The Bristol network aims to:

→ Collate and disseminate research on the Bristol City Region creative digital economy to inform wider investment strategies for innovation, enterprise and talent.

→ Produce a slate of new products and services designed to deliver regional creative economy and social enterprise development.

→ Develop new research capacity, bids and research led teaching programmes for university partners.

→ Support talent development for the creative digital economy.

→ Promote and demonstrate creativity through diversity.

→ Pioneer a regional 'knowledge commons.'

→ Iterate a series of methods for understanding, articulating and evaluating creative networks and creative clusters in cities.

A The University of Bath will continue to develop an exciting programme of artistic and creative collaborations. Photo © University of Bath.
B Residents at Watershed's Pervasive Media Studio. Photo by Paul Blakemore © Watershed.

Take risks. Develop new ways of working. Challenge the status quo. Be persistent. Be persistent. Care.