

The Practice of Cultural Ecology : network connectivity in the creative economy

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Abstract

This paper reflects on approaches to collaborative knowledge exchange (KE) projects between UK universities and the creative economy. It develops a preliminary account of cultural ecology as a systematic approach to producing impact in the creative economy. It argues that such an approach is a powerful way to aggregate microbusinesses and SMEs in a meaningful network of new relationships. The paper uses social network analysis software to begin to visualise the pattern of relationships that constitute the ecosystem. The paper reports on the work of the REACT Hub, one of four Knowledge Exchange Hubs for the Creative Economy established by the Arts and Humanities Research Council (AHRC).

Keywords: creative economy, knowledge exchange, social network analysis, networks, ecosystems

Introduction

In late 2011, the UK Arts and Humanities Research Council (AHRC) established four 'Knowledge Exchange Hubs for the Creative Economy'.¹ The hubs were collaborative initiatives comprising consortia of universities and cultural organisations. Their role was to establish links and support work at the intersection between the creative economy and arts and humanities research. This largely took the form of knowledge exchange projects, with hubs funding short-term collaborative projects between businesses and academics through a set of methodologies distinct to each hub. The aim of knowledge exchange differed from one hub to the next, recognising that 'impact' of all kinds is a very broad target, and sometimes in tension with narrower aims of economic impact.

The hubs emerged in part in relation to the 'impact agenda', which refers to a set of evaluative practices used by the HEI sector to demonstrate that academic research outputs can have a tangible or measurable effect on stakeholders outside of the academy. Consequently, the hubs also become a space where new discussions about the nature of the value generated by the arts and humanities research, its impact on the development of the creative and cultural sector, and the reciprocal benefit offered to HEIs by their interaction, are being held (Moreton 2015).

The 'impact agenda' has also been understood more narrowly as intrinsically linked to the commercial imperatives in the original idea of third mission activities in UK Higher Education Institutions (HEIs). These activities have been criticised for a perceived threat they pose to 'blue skies' research, or research activities with no discernible commercial application (Shore and McLauchlan 2012). The explicit connection of the hubs to the creative economy of the UK, informed by an interest in the role of arts and humanities research in collaborative Research and Development (R&D), business development and economic impact, place them central to this debate.

¹ Apart from REACT the other Hubs were Creative Works London; Design in Action (University of Dundee), and Creative Exchange (Lancaster University with the Royal College of Art and Newcastle University)

This paper outlines preliminary research into the network of relationships forged by participants in REACT, one of the AHRC's four hubs, based in Bristol. The research has been carried out by the two lead authors in their respective capacities as Director and Research Fellow at the REACT Hub, based in Bristol. It is a piece of preliminary research from a pilot study conducted in 2013. This paper uses social network analysis software (GEPHI) to visualise connections made by individuals within the REACT network.

The aims of the paper are threefold. Firstly, to examine the kinds of outcomes and opportunities that have emerged for the hard-to-reach micro-business sector involved in REACT's funding programme, and consider what new forms of value are being generated in these collaborations; secondly to consider whether the method adopted by REACT offers a useful method for generating new approaches to cultural and creative innovation; thirdly to ask whether this method of data visualisation can reveal new evidence of connectivity, not present in other qualitative methods.

These aims are part of an ongoing research trajectory that aims to explore the practice of cultural ecology (Holden 2004). We consider whether such methods might provide a way to aggregate isolated and diverse creative talents as a way to produce value for the creative economy. We use the idea of the ecosystem to emphasise the idea that this is a complex living network sustained by many different kinds of value exchange. Inside the REACT ecosystem participants were giving and receiving all kinds of value; ideas, inspiration, trust, contacts, technology know how, employment, excitement, access to markets, start up support, publication, ideas for new research bids and new teaching programmes. This complex network of value exchange produces tangible impacts and economic value for the creative economy.

The paper proceeds in five substantive steps. The first reflects on the context in which REACT operates, reflecting on connections between HEIs and the creative economy. The next step reflects on the methods and approaches of the REACT project as it draws to a close in 2016. The third step provides a theoretical background for REACT's approach, focussing on the use of a

'cultural ecosystem model'. The fourth section presents some early visualisations. The final section offers a discussion of these findings and signals future directions for this research.

Contextualising the REACT Hub

As with the other three AHRC KE Hubs for the Creative Economy REACT was explicitly connected to the idea of a creative economy. The concept has emerged as a key field for government policy, cultural enterprises, publically funded arts organisations and the Arts & Humanities research community more widely (Howkins 2001). The definition and size of the creative economy, and its origins in UK creative industries policies (DCMS 1998) has been the object of policy research in cultural economics for the past fifteen years (Holden 2004, Hutter and Throsby 2008, DCMS 2010, Bahkshi et al 2013) This work has been part of debate about the value of culture more widely, a debate that has circulated around its intrinsic value, its instrumental value or its public value (see Hewison 2014:122 – 149).

In 2013 the Nesta *Creative Economy Manifesto* defined the Creative Economy not just as those businesses engaged in for instance, advertising, media, theatre, film or game production, but by counting all businesses where more than 30% of employees had received their primary training in a creative or arts based discipline. This deviated from established definitions of creativity in the UK economy in that it focused on creative inputs, rather than cultural outputs, as its defining category. The report calculated the size of the UK Creative Economy as 9.7% of Gross Value Added for the UK employing 2.5m people (Bakshi et al 2013: 10). This makes it a bigger sector than Financial Services at 9.4% and a point smaller than the 10.7% of *all* manufacturing (at 2011 calculations BIS 2012:10).

The major role that universities play in the Creative Economy has been primarily understood as a talent production pipeline. Both Brighton Fuse (2013) and the Creative Economy Manifesto (2013) emphasise the importance of universities in providing the human capital necessary for both

national and regional creative economy success. At a regional level the impact of Stanford University is often cited as one of the main factors in the success of Silicon Valley as the global leader in digital economy innovation (Bakshi et al 2013: 57).

Universities also intervene in the economy by offering start-up and innovation support. However, the assumptions underpinning university business support programmes are often inimical to the conditions of the creative economy. Such schemes are frequently run by university business development units, whose focus has traditionally been on tech-transfer and spin-out business models. These models assume a set of characteristics that are usually derived from, and dominated by, STEM subjects. Typically it is assumed that researchers in labs will create IP in the form of an algorithm, some bio-tech or a new materials application. Researchers or business managers then identify a market failure or a new market opportunity that this innovation might be able to answer. The innovation may then become subject to an incubator and spin-out process with links to investment from agencies like the TSB or university affiliated Venture Capital funds.

However the assumptions about university ownership and investment that are built into the tech-transfer model are frequently unsuitable for fledgling creative businesses. Investment strategies by and large have a very strong bias toward the SME sector which is understood as having the highest growth potential. These positions mirror received wisdom on Venture Capital investment which is understood as looking for high growth potential businesses that have to some extent already been 'de-risked' by getting to the SME threshold. For all kinds of reasons the creative micro-business frequently finds itself in the investment 'valley of death' when it comes to becoming a sustainable SME (see BIS and DCMS, 2011: 2). Indeed, the presumption of high growth as an unquestioned good is itself frequently problematic for creative micro-businesses which might frequently be more committed to having a sustainable creative practice rather than growing a business. If we shift the frame for the evaluation of a creative enterprise sector from 'high growth start up' to 'sustainable network', we change our understanding of

success from one derived from the perspective of tech start up to one appropriate to creative micro-businesses.

Recent research into creative sector knowledge exchange suggests universities need to develop a different approach to support activities that reflect this shift in perspective:

‘Specifically, successful models of Knowledge Exchange activity tend to have the following characteristics and principles: informal, individual and network-led; appropriate for a business’ stage of development; highly collaborative; highly networked; cross disciplinary; accessible and brokered; part of a systematised approach to innovation; include access to finance and to new markets; led by evidence and with a recognition of success and economic impact.’ (AHRC /Creative England 2013:6)

Such an approach would be more consonant with the terrain the creative economy which overwhelmingly consists in micro-businesses, (Sapsed and Nightingale 2013:14), understood here as businesses with 0 – 9 employees (Rhodes 2012). This micro-business sector is problematic for business development agencies for a number of reasons:

‘... creative R&D activities often happen in an iterative rather than ‘linear’ way, and ... involve sole traders and micro-businesses that, ... are invisible to official surveys, it should come as no surprise that they can go ‘hidden’ and unsupported.’ (Bakshi et al 2013:52)

Creative R&D tends, for instance, to be based on talent, rather than driven by the production of Intellectual Property (IP). Instead, its creativity and invention may well be in repurposing existing IP and platforms rather than creating new IP. Conventional technology investment and growth patterns have been predicated on the invention of protectable IP.

These businesses are also very dynamic, fluid and informal. They are the domain of the precarious creative class, where freelance workers might have several income streams as well as their own brand or label (McRobbie 2011). In addition the micro-business sector is frequently written off as 'lifestyle' business, that is to say a business with no interest in growth 'merely' maintaining its turnover in order to support a particular 'lifestyle'. This derogatory use of the term 'lifestyle business' is of course in direct contradiction with the Richard Florida's arguments about the value of a creative class to urban economies where quality of lifestyle becomes a key driver of success (Sapsed and Nightingale 2013: 37 – 42). This contradiction between conventional growth metrics and the network effects of creative work clusters hints at the REACT approach which was been to attend to the whole network rather than just the strongest nodes within it.

REACT's Approach

REACT (Research and Enterprise for Arts and Creative Technologies) was established in 2012 as a collaboration between UWE Bristol, digital media centre Watershed, and the Universities of Bath, Bristol, Cardiff and Exeter. Over the course of four years REACT funded 53 collaborative R&D projects, each comprising at least one academic from an arts and humanities background, and a company from the creative sector. In total, REACT supported 57 creative companies and 73 academics to collaborate. The broader network of those associated with REACT projects through bids, event attendance and other forms of non-financial support now stands at over 600 individuals. This community is professionally diverse, with over 63 academic sub-disciplines and research areas, and a wide range of creative businesses, including theatre makers, choreographers, app makers, technologists, coders, artists, product designers and more.

The Hub supported projects who produced a range of products and prototypes at the physical/digital interface: e.g. battling robots, light-up swings, collaborative games, augmented books, new literary experiences, and interactive documentaries. It invested £2.5 million directly in projects,

stimulating £5,353,569 in further investment in projects from private investment, new research funds, product sales and commissions at the time of writing. The REACT projects led to the creation of 10 new companies and 30 jobs in the sector to take these products to market or develop ideas further.

REACT required a method to a) bring a network together b) provide practical support for members of that network for them to develop prototypes and c) support a core group or cohort of diverse individuals and projects.

The REACT method outlined below brought this network together to share ideas, solve challenges, provide peer critique, offer help, share opportunities and play. In the case of REACT this network comprised individuals, companies, advisors and funded projects. The network of industry advisors who volunteered to mentor, support and broker the project were essential to helping the projects engage with users and markets.

Central to the maintenance of this network is the role of the Creative Producer (Tyndall 2007) whose role was to generate connections between people and institutions via networking and advocacy activities, support and broker potential collaborations, help develop ideas with creative and practical advice, and support members of the network and successful projects. This support includes offering advice, sourcing support, and responding to the needs of the projects. The creative producer acts to engender core principles in this cohort: a generosity of ideas, a willingness to test and iterate and consider audiences, as well as to be open to peer review. The role of the Creative Producer has been key to REACT's research and development methodology. Watershed has identified producers as playing a central role in the development of the cultural and creative economy, and has bought that approach to REACT

REACT's primary funding model has been Sandbox, adapted from Watershed's existing Sandbox methodology and delivered by a team of Watershed Creative Producers, dedicated to REACT projects. REACT have run five Sandboxes each with their own theme. These have explored

Heritage, Books and Print, Future Documentary, Internet-connect Objects and Play. Each of these themes was generated in consultation with creative economy advisors. They appeal to those sectors most in need of research and development to respond to the disruptions of technological innovation.

The starting point of the REACT Sandbox were Ideas Labs, an event where potential applicants from academia and creative industry meet to develop ideas. Across the programme, REACT hosted 12 Ideas Labs across Cardiff, Exeter and Bristol, attracting 672 attendees.

After Ideas Labs, collaborative teams were supported by REACT Producers to develop bids. Teams applied through a light-touch application form that asked them to propose their activity and ideas, and provide a budget. Projects were selected for interview by a mixed panel of industry and academic advisors. Final projects were selected for a Sandbox on the basis of the quality of the relationship in the partnership. A cohort of between six and eight projects was chosen that represents a diverse range of skills, approaches and knowledges. Some projects were relatively straightforward, while others more risky. Curating a 'slate' of projects is a core component of the method, where innovation is stimulated through a mixture of project types, ambitions and talents.

The REACT Sandbox production period ran for three to four months during which time every project is required to produce a working prototype that can be tested with audiences. Successful project teams were awarded up to £50k per project to carry out this work. Up to £10k went towards the company's R&D investment in the project (most often their time) and the remaining £40k allocated to academic time, HEI costs, travel, materials and other project resources such as prototyping, manufacture and testing, or subcontracting additional expertise.

During the Sandbox period, teams were required to meet for day long sessions at least once a month, to share progress and get specialist appropriate input from their relevant sector or market organisations. The whole process is co-ordinated by a Creative Producer with a supporting team of industry advisors, a specialist business mentor, PR and legal coaching. Projects were also supported in applying to next stage funding and investment by the producer team. Each project participates in a public showcase within two months of the end of the programme and each project had its own five minute film as a promotional tool.

The REACT Sandbox is distinct from other KE or business development processes partly because of its insistence on cohort based learning and the necessary generosity that underpins it and partly by its use of iteration with audiences and users to allow projects to change and develop. The net effect is of a process that fosters the kind of hyper-connectivity between people, disciplines and technologies that creates a great deal 'more than the sum of its parts'. Modelled on principles of Open Innovation, it also places care for its participants, and generosity of ideas and skills as central to its operation.

Cultural Ecology Background

The method described above can be understood as way to implement the idea of cultural ecosystems as a practice. The idea of the 'cultural ecosystem' was first coined in 2004 (Holden 2015:15). Whilst it is clearly a resonant epithet for the complex work of socialised creativity, there is little systematic analysis of 'cultural ecology' as a practice. This paper adopts a working definition of cultural ecology from Ann Markusen et al; 'the complex interdependencies that shape the demand for and production of arts and cultural offerings' (Markusen et al 2011, p.8). Thinking 'ecologically' suggests we look at the assemblage of agents that constitute cultural ecosystems. Acting ecologically suggests activating a range of agents in any given system.

The idea of complex networks characterised by emergent behaviours and properties is of course particularly resonant for the historical moment of digitally mediated social networks (see Jenkins et al 2006 on participatory dynamics). These approaches have been developed as analytic frameworks for understanding the overall dynamic of a network (Potts et al (2008), Comunian Alexiou and Chapain (2012) and Hartley Wen and Li (2015)) however nowhere is there substantive work on what an ecological *method* for the work of creative economy might be.

This cultural ecology project has emerged from the Pervasive Media Studio where REACT is based, from the Sandbox method developed by iShed, and from research into creative networks and their values carried out by Watershed in conjunction with the Digital Cultures Research Centre (UWE Bristol) and Bill Sharpe (International Futures Forum) (see Sharpe 2010 and Bachmann, Dovey Monaco and Sharpe 2012). This research suggested that innovation functions best when understood as a network effect of a group of people, often in different professions and with diverse skills, being provided with time and space to develop and test new of ideas to address social, creative and technological challenges. These methods were designed to have the effect of constantly strengthening the local creative ecosystem; small creative players aggregated together in co-located spaces, times and social media constitute networks of creativity and innovation. These networks are driven by sharing ideas and resources, and by the new forms of interdisciplinarity brought into being by digital technologies.

These general approaches gained traction for REACT where they intersect with business and organisational studies, especially around studies of the benefits of co-location and clustering for economic growth (see Borgh, Clodt and Romme 2012). We have also drawn on the work of Rafael Ramirez who has developed the idea of the value constellation as an alternative to the value chain. (Normann and Ramirez 1993). The 'value constellation' understands value as a property co-produced by many agents in a business network rather than being created and consumed in a linear value chain. This concept is particularly compelling as a way of thinking about the value

produced through co-creation. Ramirez (1999) showed how the distinction between value chain and value constellation is appropriate to the logics of co-production. Digital innovators in the creative economy are increasingly driven by a logic of co-creation, where value is produced for the business and the user through their interaction around a service or a platform. Importantly for our method however Ramirez' approach stresses the importance of the coordinating agent of any value constellation: these systems do not just evolve, they are designed and curated. We argue that they require a particular kind of agency at their heart where networked value creation is supported and directed by creative producers.

Visualisation

This section is based on a preliminary attempt to use social network analysis software to visualise the way that we think value constellations in the creative economy can operate. We have visualised interview data in an attempt to uncover the different kinds of connection forged in the REACT community. It is an attempt to show the density of connection aggregated by this method of organising creative labour.

The data presented is drawn from our Books and Print Sandbox, which ran from January to April 2013. We have taken all the professional and location data gathered from our initial workshop participants, and undertaken eight research interviews with lead business and academic partners from one entire cohort of Sandbox participants. We then analysed the interview data, coding it for instances where subjects talked about meeting or working with new people, making new connections and forming new working relationships. Data was then visualised using open source software GEPHI. This research is a pilot project, and has become part of a longer, more rigorous research process currently underway which explores the whole REACT network and does more work on the nature, value and temporality of the connections made.

We can show the data in the interviews in a numerical form. The table below

shows the connection data from seven Sandbox participants. We have simply counted up the number of references participants made to making new connections or to significant working relationships developed in the Sandbox. In the table 'Academics' were lead project partners, 'Producers' are part of the REACT delivery team; 'Creatives' are the lead creative business partner and contractors (including designers, programmers, artists, and writers); 'Mentors' are lead industry figures who attend workshops and offered one-to-one advice to projects. The final 'Contractor' line is for a writer who came into the process working on a project.

Subject	Connection Total	Academic Connections	Producer Connections	Creative Business Connection	Mentor Connection
Academic 2	13	5	4	3	1
Academic 1	16	5	4	6	1
Academic 3	15	0	5	6	4
Creative 1	10	5	2	3	0
Creative 2	13	4	4	4	1
Creative 3	17	5	10	5	0
Creative 4	8	1	3	4	0
Contractor	16	7	2	5	3

Table 1: number of connections made by participants in REACT Books and Print Sandbox

Figure 1 (below) shows the initial set of subjects who came to our three Ideas Labs in June 2012. Ideas Labs are the initial ideas generation days that begin the REACT Sandbox process. Three were usually held in different locations across the South West. They are led by an external facilitator with the whole REACT delivery team in support. The Ideas Labs generated both new relationships and project ideas. Here the pale blue dots are the creative

business partners and the dark blue dots are the academics. There were 197 individuals (academics and businesses) in attendance at these events, many meeting up with one another for the first time.

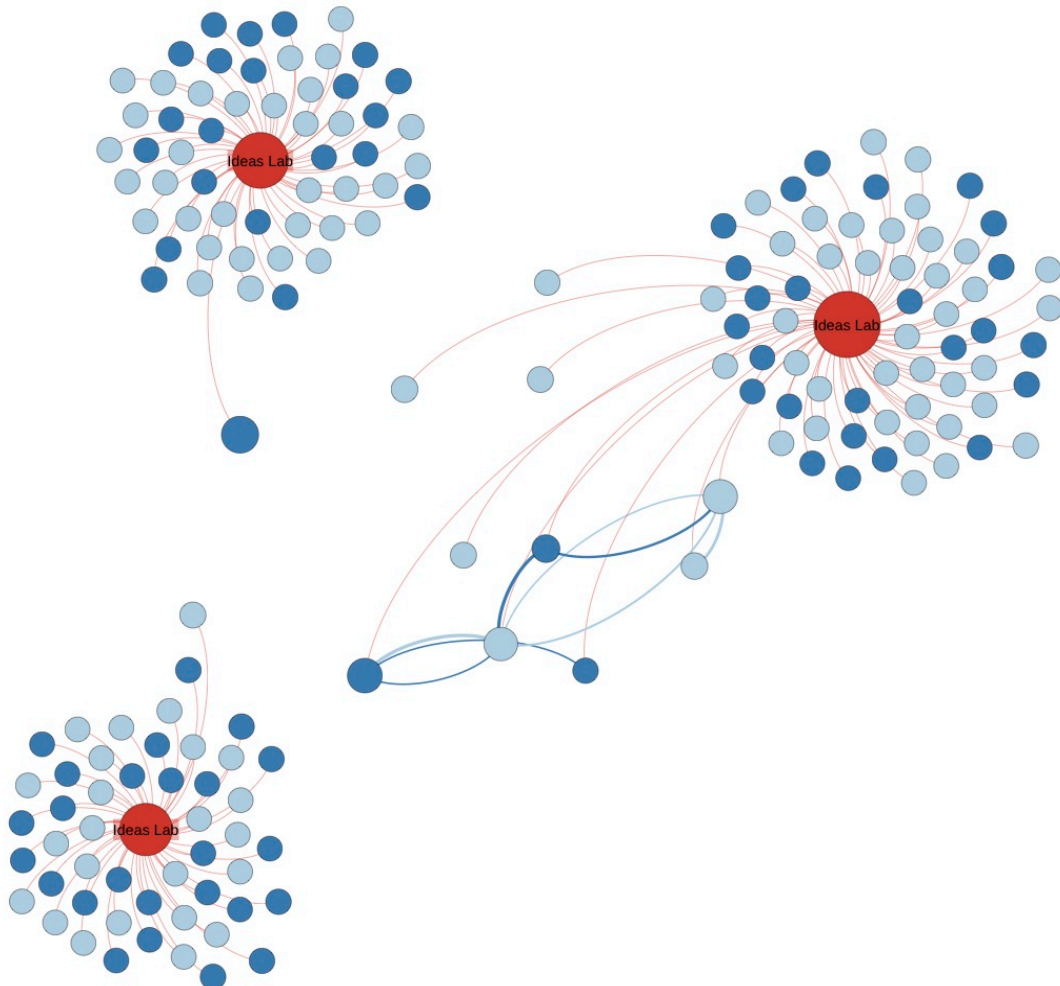


Figure 1: Visualisation of initial Meetings at Ideas Labs for the Books and Print Sandbox Autumn 2013.. Red : Ideas Lab Event. Light Blue Creative Business Partner. Dark Blue Academic Partner

These preliminary conversations were then developed and supported by the REACT creative producers and university research development teams. In this instance they became 26 project proposals. In the visualisation below (figure 2) the pale green dots are bids generated altogether and the 8 dark green bids are those awarded REACT Sandbox funding. These funding awards were made two months after the Ideas labs.

Figure 2 shows the complexity of inter-relationships developed through the three-month Sandbox process at the centre of the diagram. Here all the agents in the system, including REACT staff, mentors, and contractors are shown. The pink dots are project mentors from the relevant industry sector bought in to support project development and the orange dots are members of the REACT team including freelance business development advisors and PR and legal teams bought into the Sandbox. Dark blue are academic partners and pale blue creative business people. Contractors are also pale blue, and represent creatives or research staff brought into a project by the lead partners. These include artists, writers, musicians, designers, coders or Research Assistants. The large blue nodes are Project lead partners. We can see the complexity of relationships formed by the process in the centre of the diagram.

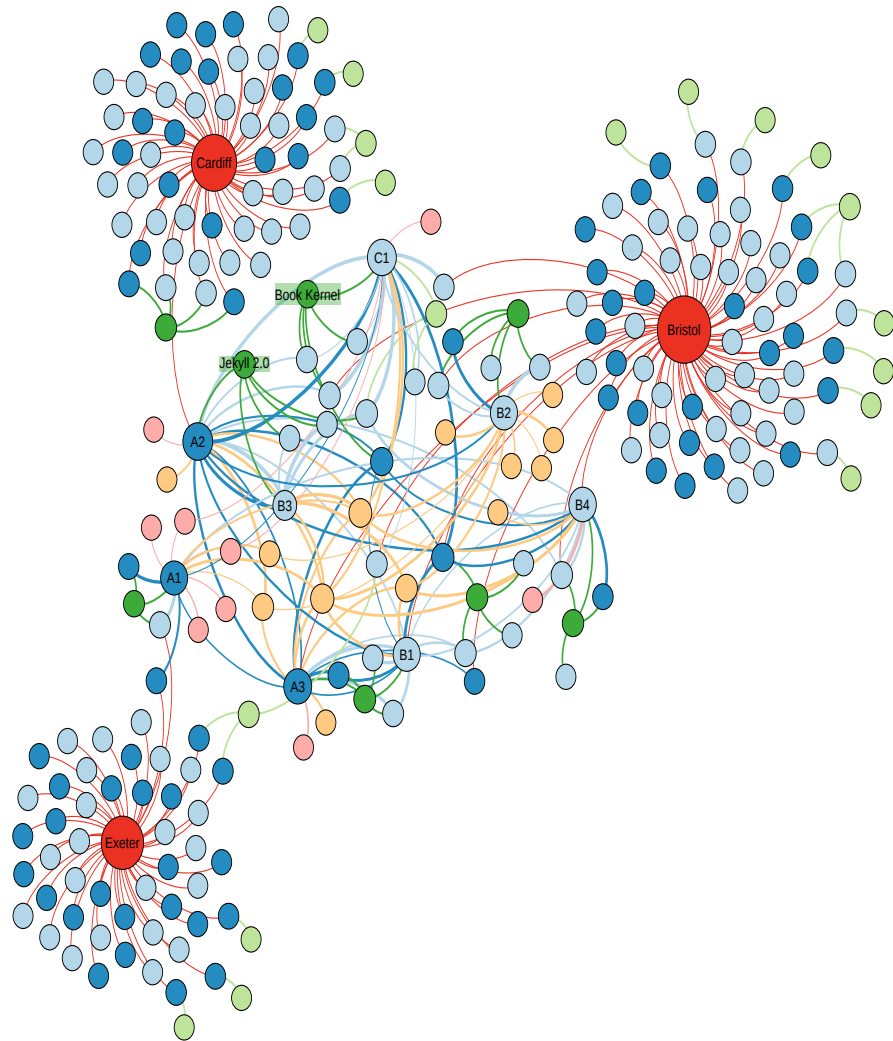


Figure 2 Visualisation of relationships at the end of Sandbox. Red : Ideas Labs. Light blue : Creative Businesses and contractors. Dark Blue Academic Partners. Dark green: Sandbox Funded Projects. Light Green: Non Sandbox Project Bids. Pink: Mentors. Orange: React Team

Figure 2 also gives some sense of how the initial collaborations from the Ideas Lab stage become active in the Sandbox itself, the section of interconnected dots in the middle of the illustration. The lines connecting the agents represent the new connections that subjects reported in their interviews. If we isolate the Sandbox part of the visualisation (Figure, below 3) we can start to see the variety of connections being made in more detail.

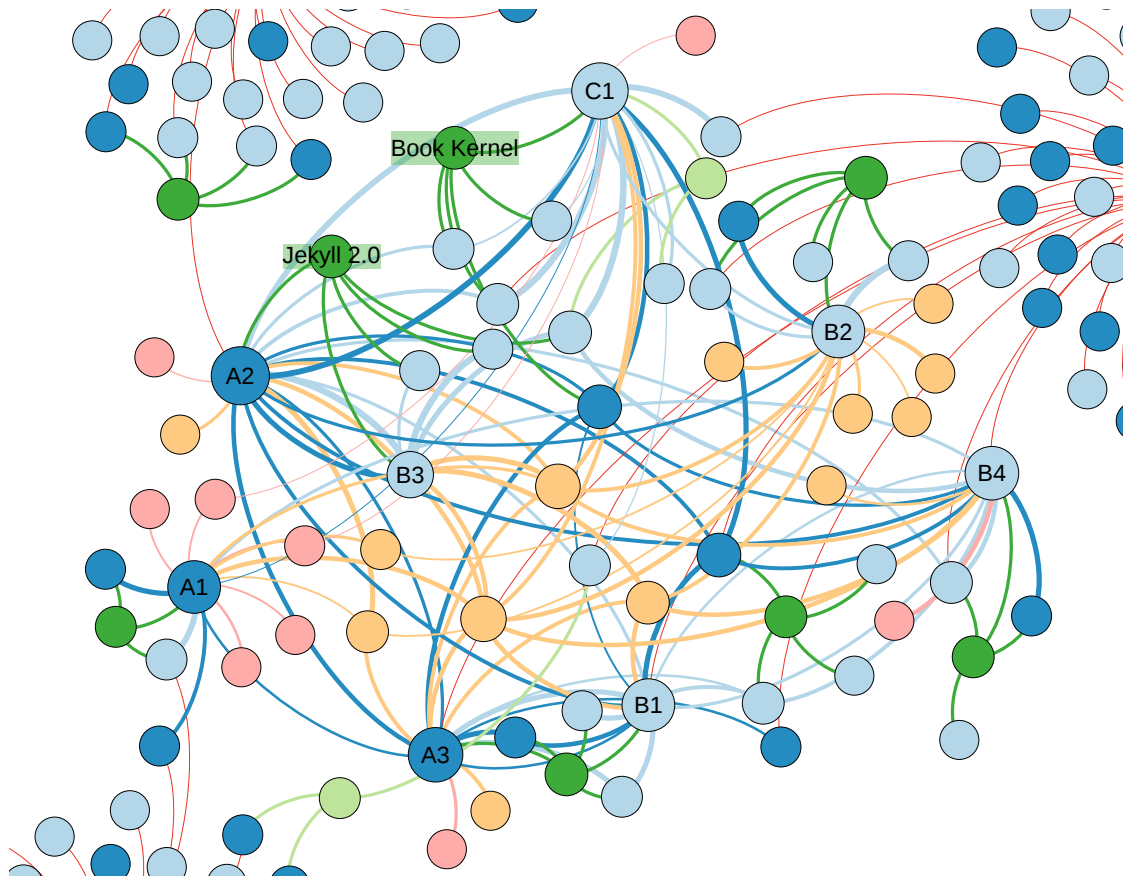


Figure 3 Sandbox Connectivity in more detail Light blue : Creative Businesses and contractors. Dark Blue Academic Partners. Dark green: Sandbox Funded Projects. Light Green: Non Sandbox Project Bids. Pink: Mentors. Orange: React Team

The first thing we can observe is that the method created a complex web of interconnectedness. The interviews reveal a lot of comments that reflect an appreciation of the connectivity produced by the method, for example,

"Perhaps what has to be preserved is a sense of family, of a belonging to a process. So the people involved in that come together in relations and act as platforms for further development." (Books and Print Sandbox Participant)

There are also more specific accounts of how connectivity produced new relationships and new possibilities, in this case for an academic:

"So I've seen lots of opportunities where I can maybe use the networks that I have as well with people, and also forge new networks with people and potential projects or ways forward. So I think (X Creative Business) and I are arranging a meeting for later on this summer to think about collaborations (...) I think (Y Academic) wants to have a chat with me about (Project) (...) So academics from my institution that I've never met before. So I met (A , B) and various other people. So that's been very good for that as well." (Books and Print Sandbox Participant)

This research shows that REACT has a system that forms new relationships and new networks, but what is their value? To understand the meaning of these relationships we turn to narrative. There are some stories in these interconnections that reveal the long-term economic and cultural value of the 'connectivity added' system that REACT produced. We can look here at two examples, one an academic, the other a creative contractor.

This diagram shows the connections made by the lead academic researcher (big dark blue dot) as part of the specific prototype production that he was leading.

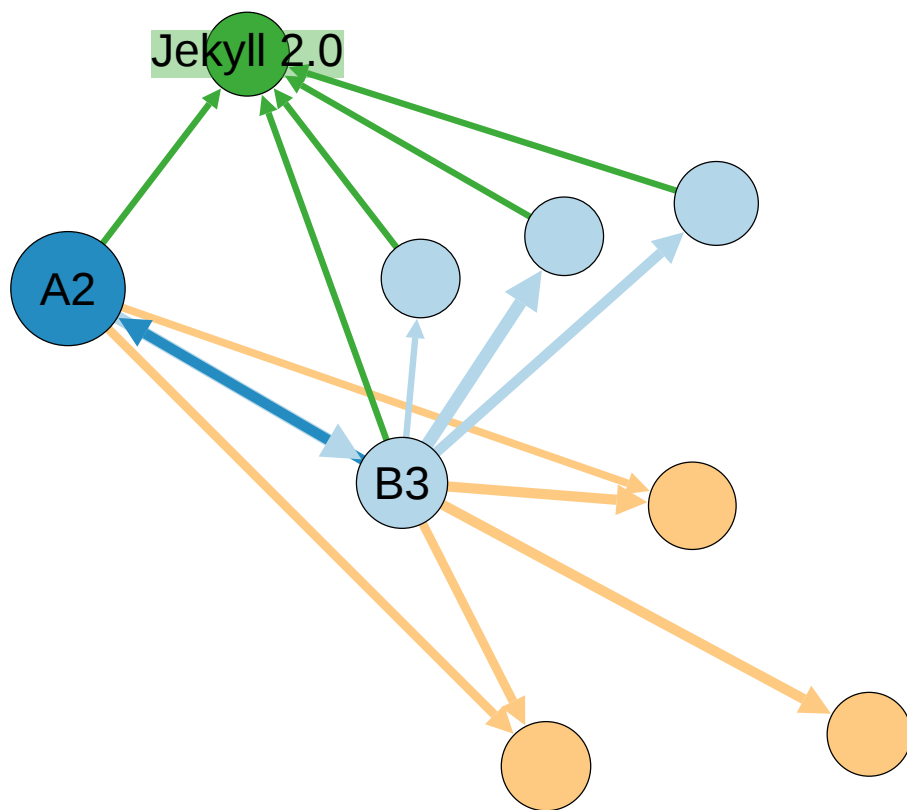


Figure 4 Visualisation showing project Graph 1 Jekyll 2.0 A2 Lead Academic B3 Lead Creative Project Connections graph

The diagram shows within the specific project that the academic connected mainly with the lead creative and via that node to three other creative contractors involved with the project. However when we look at the connections made by this academic across the whole Sandbox (figure 5, below) we see a far richer pattern.

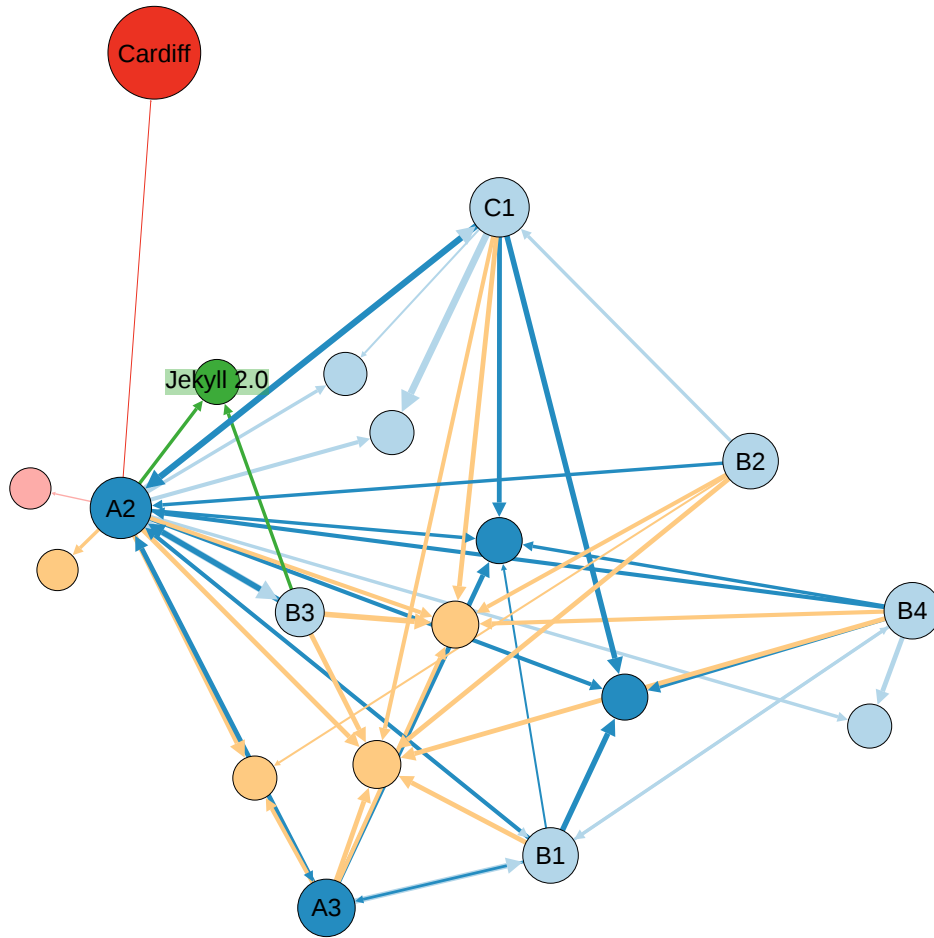


Figure 5 Personal Graph Academic A2 showing wealth of new connections outside his specific project.

In this case we can see that the academic has also formed strong relationships with another lead academic (A3), two other academic contractors, several creative businesses outside of his particular project (B1, B2, B4) a creative contractor (C1), producers (Orange) and a mentor (Pink). In particular two of the relationships with creatives (one writer and one creative business) are investigating potential for future collaborations,

"I'm really interested in fostering links with people from other projects like (Project) and I've been talking with (Creative Business) about a collaboration, maybe using things like (Platform developed in Sandbox), so I chatted to him and (Academic) about that.." (A2 in interview)

Our second example highlights the benefits for individual creative.

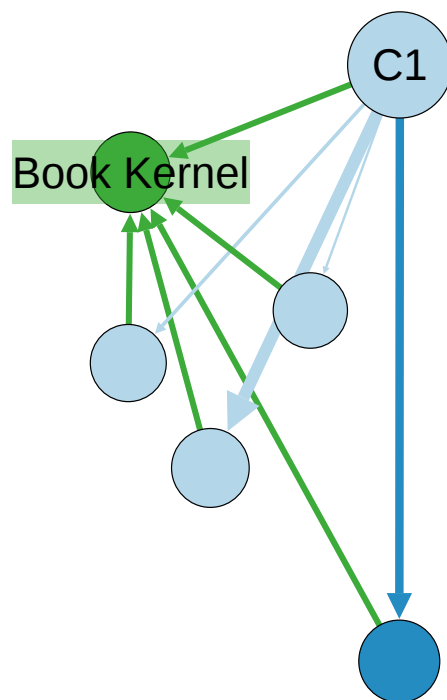


Figure 6: visualisation showing connections of sole trader working as contractor project connections

The contractor in the diagram above (large light blue dot) is a sole trader who came into Sandbox as an editor to co-develop a particular project. The graph above shows his connections with the academic and other contractors on his particular project. However he became a key participant in the whole Sandbox. His individual connectivity graph (figure 7) demonstrates the complexity of his connections.

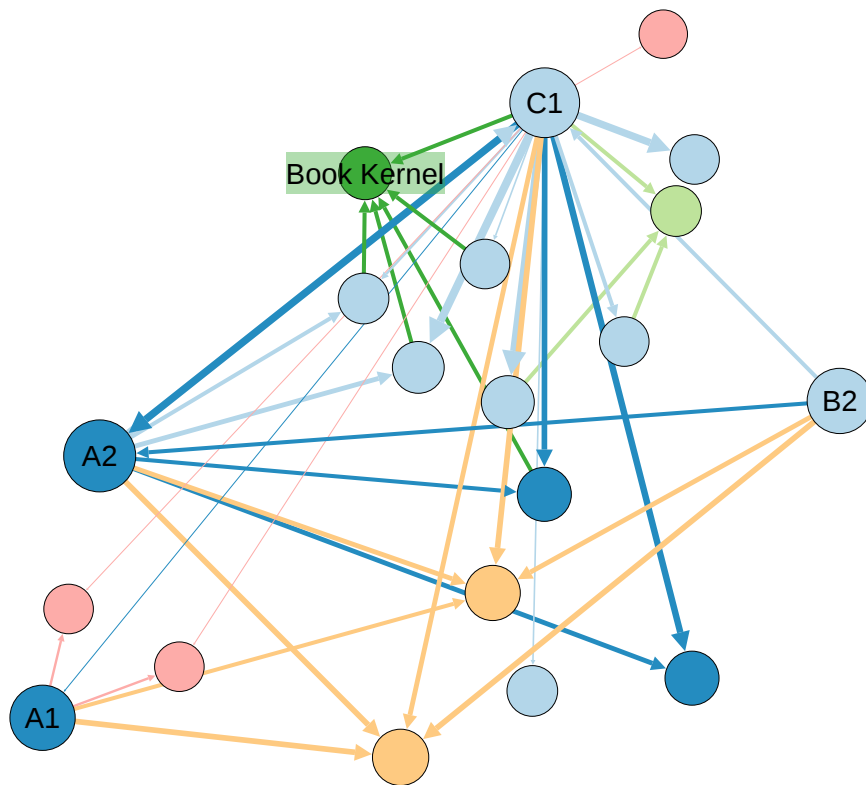


Figure 7; visualisation of sole trader connections graph for the whole of the Sandbox

Figure 7 shows how he connected with another project, (green) two other academics (dark blue), three other contractors (light blue) and two mentors (pink) and the REACT team (orange). The project that he was working in in the Sandbox has launched itself as a business where he is the lead producer, and has so far had three commissions: for the Guardian, the BBC and the Arts Council. Each was substantially facilitated by the mentors (Pink) and REACT producers (Orange) above. The contractor has also formed another new business, for a story content generating app, with another contractor he met in the Sandbox which has won a £3k business development investment.

He has also been employed as a writer by a games company he met during the process and has co-produced an exhibition with an academic from another university that he met in the Sandbox cohort (A2).

This illustrates how one sole trader becomes connected through the REACT Sandbox method, launching two micro-businesses and finding freelance creative work through the process. If we look across the range of projects as a whole in this cohort we see how the values in individual relationships start to scale up. A web of relations and potential exists where none existed before.

Discussion

The question of cultural value has been the object of a great deal critical attention in the past decade or more (see Crossick, G. and Kaszysnka 2015, Hewison 2014, Bakshi et al 2013, O'Brien 2010). This paper has looked less at the consumer, policy and 'value for money' debate but refocuses the discussion on the supply side of cultural value. Our argument is that this 'ecosystems' approach to managing networks is not only a metaphor for describing connected activities, but also a method for generating value. This approach offers a method for both the creative and university sectors to support the development of a sustainable micro-business sector in the creative economy.

The productive value of HEIs, cultural agencies and creative micro-businesses in the creative economy is understood as a driver for city and regional development (see eg Landry 1999, Florida 2002, Chapain C. and R. Comunian (2009). CEBR (2013) tabulates the regional benefits of successful creative economy as economic, social and environmental, whilst Hartley et al (2012) designed a creative city index of eight dimensions and 250 indicator measures as a hermeneutic for assessing the creative city.

Where creativity is understood as a key asset for regional development cultural agencies are constructed as the first port of call in its delivery strategy. The impact of cultural production for the creative economy in this

context is framed through economic cluster theory (Chapain et al 2010) where particular industries thrive through co-location that produces shared talent, expertise, natural or human resources. The challenge for cultural agencies, micro-businesses and SMEs operating within these complex webs of creative production is to be able to identify and understand their position and impact within them. Chapain, Alexiou and Communian (2012) identify three scales (micro, meso and macro) of creative economy operating within a city or region whilst Cohendet et al (2010) prefer underground, middleground and overground as a way of classifying the operational layers of the network.

By aggregating SMEs and micro-businesses under the umbrella of a branded cultural organisation (Watershed) they are afforded a platform that sits at the middle or meso-level of the creative city system. Individually isolated collaborations across the whole range of the creative sector may be invisible. Together they can aggregate resources, skills, ideas, attention and connections to a market in a way that enhances the impact of each project above and beyond its own singular potential. Membership of a cohort of diverse skills together with a £10k R&D budget and some academic expertise can have a huge stabilising impact on new enterprises at the start of their journeys, making the difference between a dream and a reality. Looked at systematically this massive messy dynamic sector is the 'hatchery', the promiscuous breeding ground for successful future creative enterprise. The REACT practice of cultural ecology has clear benefits for the creative micro-business and SME sectors.

We know from both formal interviews and informal conversations that the participants considered these connections to be a significant part of the Sandbox experience. REACT has bought in an existing methodology devoted to iterative production that is based on crowding diversity of different skills, disciplines and approaches in order to achieve its Knowledge Exchange aims. Explored systematically, the 'product' of REACT is actually project alumni and the relationships they sustain. Whilst funded *objects* are the new prototypes, products and services that are designed the *aim* is a network of relationships that continue to strengthen the network of the regional creative economy.

Curating connectivity by crowding diversity is one way to aggregate fragmentary creative talent into a critical mass that can create sustained impact. The evidence above suggests that the methods we have been adapting and deploying here could have a role to play not only in addressing the problem of the 'hard to reach' creative micro-business sector but also across other cultural and creative economy institutions who could benefit from understanding more clearly their role as aggregators of talent and curators of networks.

This paper has also suggested that by using SNA software for visualisation, it is possible to demonstrate that an ecosystems-informed method delivers and intensifies connectivity. An extraordinarily transformative set of new relationships can be observed in the detail of Figure 3 above. It visualises the process through which fragmented creative talent builds networks where participants can locate and explore mutual interests and values with long term potential. The outcomes reflect the variety of values at work in the links between agents in Figure 3. Start ups, research bids, enhanced businesses, new degree programmes, research papers, and new products are all produced through the process.

The data used in this pilot is by no means definitive. More research is needed to discover for instance how many of these connections are new and in how many cases the Sandbox provided the opportunity for prior connections to be translated into productive collaborations and R&D activities. We would also like to do more work on what the quality and value of these relationships will be in the long term. Our new dataset will have information about the quality, utility and longevity of the relationships formed between the projects in receipt of REACT investment. This will enable us to make more sophisticated visualisations which we hope will do more than merely represent the relationships that form a successful hub. Finally we await the publication of analysis of the three other AHRC Creative Economy Hubs in order to be able to conduct comparative research across their very different methods in order to further test our results.

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