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Data-Driven Innovation in the Creative Industries

Edited by Melissa Terras, Vikki Jones, Nicola Osborne and Chris Speed

DATA-DRIVEN INNOVATION IN THE CREATIVE INDUSTRIES

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LONDON AND NEW YORK

"This book captures the essence of data-led creativity – delving into the policy challenges and ethical considerations which affect this major growth sector. With some amazing real-world examples, this book constitutes a must-read for anyone wishing to learn about shaping the future of creative economies."

Dr Frank Moeschler, MBE

"The Creative Industries were first defined 25 years ago, and this collection of essays is a watershed in the maturity of the sector. Combining sharp analysis of the need for better data about the creative industries with case studies on how data drives innovation across the sector, these new approaches will catalyse the next stage in the journey of the creative industries to their proper place at the very heart of our 21st-century prosperity."

Professor Christopher Smith, *Executive Chair of the Arts and Humanities Research Council (AHRC), UK*

"This UK Creative Industries Cluster Programme has shape-shifted perception of the creative industries, revealing the true value of creativity and the creative leadership informing industries from healthcare to AI. This important collection of essays is a timely account of data-led innovations illustrating the collaborative potential of technology, making tangible emerging, and exciting, approaches to creative practice."

Professor Jane Harris, PhD, FRSA, *Chair of Digital Design & Innovation, University of the Arts London*

" 'The Design Economy – The Value of Design to the UK Economy', published in 2015 by the Design Council, was the first report to really articulate a new definition of design and its importance as a driver of value and innovation in the UK. There have been several similar reports since, but this book takes the argument to the next stage, clearly putting the case for how design and data can come together as an essential part of the Creative industries to make a real difference to the world."

John Mathers, *Chair, British Design Fund and ex-CEO, Design Council*

"A timely reflection upon five years of inspiring research by the Edinburgh Creative Informatics team in their work both for and with their creative industries cluster organisations. A clearly articulated agenda is established for how data-driven innovation should be embraced, rather than feared, at the heart of our creativity."

Professor Damian Murphy, *Professor of Sound and Music Computing, University of York, UK*

"This book is full of insights for the current challenges that creative companies are facing today with data management and innovation."

Pierre Roy, *University of Montpellier, France*

"This book goes beyond the theoretical – offering immediate insights for creative practitioners and industry leaders alike by delving into real-world applications and ethical considerations. The exploration of innovation in this collection of essays champions the collaborative potential of creativity and technology and encourages the adoption of data-led creativity to shape the future of the creative economy. A must-read for those looking to drive meaningful change and innovation across the industry."

Lee Walters, *CEO of Ffilm Cymru Wales. Formerly Programme Manager of Clwstwr, part of the Creative Industries Clusters Programme*

"This book brings to life real-world applications of data-led creativity and, importantly, addresses ethical considerations. It is essential reading for anyone interested in exploring the future of creative economies, offering profound insights to drive meaningful change."

Sara Louise Pepper, *Co-Director of the Centre for Creative Economy and Deputy Director of Media Cymru at Cardiff University*

"Economists and management scholars speak of the benefits of data-driven decision-making and policymakers champion data-driven innovation. But what do these mean in the creative industries context? The essays in this timely volume describe in concrete terms the different ways in which practitioners, policymakers and other agents within the creative innovation ecosystem are grappling with data. It's a must-read for anyone interested in understanding innovation in the creative industries today."

Hasan Bakhshi, *Professor of Economics of Creative Industries at Newcastle University and Director of the AHRC-funded Creative Industries Policy and Evidence Centre (PEC)*

"Digitalization has challenged a number of conventions and established practices in several industries and enabled a greater capacity for working from within the in-betweens of disciplines and sectors. It opens a new era of creative work. The inter- of disciplines and the cross- of sectors is where we need to inquire, learn, and experiment. Whether you practice this, looking for new knowledge, or research or support practice – this book will prove a most inspiring companion on your adventure."

Charlotte Lorentz Hjorth, *Head of ekip collaborative platform (European Cultural and Creative Industries Innovation Policy Platform), Lund University Collaboration Office*

DATA-DRIVEN INNOVATION IN THE CREATIVE INDUSTRIES

The creative industries – the place where art, business, and technology meet in economic activity – have been hugely affected by the relatively recent digitalisation (and often monetisation) of work, home, relationships, and leisure. Such trends were accelerated by the global COVID-19 pandemic. This edited collection examines how the creative industries can be supported to make best use of opportunities in digital technology and data-driven innovation.

Since digital markets and platforms are now essential for revenue generation and audience engagement, there is a vital need for improved data and digital skills in the creative and cultural sectors. Taking a necessarily global perspective, this book explores the challenges and opportunities of data-driven approaches to creativity in different contexts across the arts, cultural, and heritage sectors. Chapters reach beyond the platforms and approaches provided by the technology sector to delve into the collaborative work that supports innovation around the interdisciplinary, and cross-sectoral, issues that emerge where data infrastructures and approaches meet creativity.

A novel intervention that uniquely centres the role of data in the theory and practice of creative industries' innovation, this book is valuable reading for those researching and studying the creative economy, as well for those who drive investment for the creative industries in a digitalised society.

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For the Creative Informatics Community.

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FOREWORD

Over the last decade it has become increasingly obvious that the future success of the Creative Industries, from screen to performance, museums to fashion, is ever more closely entwined with advanced technologies– be that real-time computing, XR technologies, AI or data science. The transformation of the creative sector is part of a vast industrial change enabled by the digitisation of the economy, making this book incredibly timely with its dispatches from the frontline of data-driven change.

This collection draws on five years of pioneering work by the Creative Informatics cluster and their partners, demonstrating that data-driven innovation has the potential to change practice, improve policy and deliver more inclusive and sustainable outcomes ranging from approaches to skills development to creative and business ethics. Data-driven innovation (DDI) embodies the energy, ambition and appetite for change of the (largely) Edinburgh-based community which has done so much to drive forward thinking in this area.

The book raises key issues that have to be addressed if the Creative Industries are to capitalise on data-driven approaches; the authors identify the actors who can make the necessary changes and ask a series of provocative questions. Though the answers are inevitably provisional, they are always insightful.

One concern that almost all authors turn to is the challenge of adequately capturing through data the contribution of freelancers and micro businesses within local, regional and national innovation ecosystems. Here you will find DDI approaches to explore the operation of freelance networks that apparently offer alternative governance structures within clusters.

Several authors also identify the importance of freelancers and sole traders in research and development (R&D). Questions remain as to whether the numerical preponderance of freelancers and micro business is matched by their engagement with R&D and an ability to capture value from it. From skills to equity, diversity and inclusion (EDI), these segments of the creative workforce are surely critical in delivering change, but until we have an evidence-based and data-driven model of how R&D and innovation operates across the Creative Industries, there is a risk of valorising precarious workers as heroes.

This book is full of the diverse ideas and dynamic challenges that have typified the work of Creative Informatics. You'll find proposals for dynamic data-driven alternatives to the old industrial and occupational classifications and case studies featuring the new, data-smart companies who are developing the real-time classifications we need to capture the rapidly changing creative economy. Elsewhere authors sift through the wreckage of the NFT debacle and rescue the re-conceptualisation of digital property rights as a potentially significant shift emerging from the debris.

One particularly striking proposition is that within the Creative Industries insight should be driven by 'small data' approaches in contrast to the Big Data so beloved of tech firms and AI training sets. Small data is locked up in tacit knowledge or pockets of practice within companies and organisational information. If creative firms can work with new data providers who can access this 'dark matter', they will uncover a new engine of growth. As one interviewee reveals, the public sector leaders responsible for the creative industries currently make choices determined more by their intuitive feel for this dark matter rather than any actual data.

There are warnings here, too: on the practical role of universities in creative cluster networks, on the ongoing challenges of data capture across the creative industries, and above all on the (perceived?) lack of clarity in defining the creative industries. This latter is something that should stimulate a conversation, timely in the year the existing UK definition celebrates its 25th birthday.

All of the authors locate the work of Creative Informatics within government policy, acknowledging the role of the 2017 UK Industrial Strategy and its subsequent Challenge Fund and the Arts and Humanities Research Council's Creative Industries Clusters Programme (CICP), which supported Creative Informatics as one of nine place-based R&D Partnerships between universities and industry across the UK.

I was honoured to lead the Clusters Programme as Challenge Director, watching the evolution of the partnerships and their developing specialisations in screen, fashion or, in the case of Creative Informatics, data and AI. At the start of the programme, I drew a distinction between the prevailing mode of research *about* the creative industries and this new opportunity of applied research *for* the creative industries. This book shows that DDI has

the potential to deliver both. Making creative organisations and workers data literate enables them to transform practice and R&D, but wider access and improved quality of data enhances understanding of the dynamics of the whole system, delivering change through R&D, through Equality, Diversity, and Inclusion initiatives, and ethics, or through policy.

The AHRC Clusters programme was at the time the largest-ever commitment of R&D funding to the UK's creative industries. As AHRC follows this with an even larger creative infrastructure programme *and* a successor to CICP, I'd like to congratulate all the authors of this book, and Chris Speed, Nicola Osborne, Vikki Jones and Melissa Terras in particular, on showing not only how high a bar they have set in terms of the quality of applied creative research but also demonstrating the pivotal role that data-driven innovation can play across the creative industries.

Andrew Chitty
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1

INTRODUCTION

Framing data-driven innovation in the creative industries

Melissa Terras and Vikki Jones

Abstract

The creative industries – the part of the economy creating new products, services, and experiences at the juncture of arts and business–have been greatly affected by digitisation of our society. As well as the changing nature of technology and its creation and delivery mechanisms, there is a need for expertise in how creatives can innovate with and around data to build successful business ventures. This edited collection specifically examines how the creative industries can be best supported to make use of data-driven innovation and digital technology opportunities, and this introduction defines and examines our core terms: the creative industries, data, and innovation. Taking a pragmatic, critical, and broadly framed view, we encompass the production of novel goods, experiences, products, and services via creative practice and creative endeavours, uniquely centring the role of data. Although many aspects of innovation are economically driven, we stress the potential for social good and social enterprise, identifying wider issues concerning the global information environment and how to innovate successfully within it.

The creative economy – defined by the United Nations as the part of the economy that is "at the crossroads of the arts, business and technology" (United Nations, 2008, p. iii) is a large driver of social benefit as well as financial growth. In the case of the UK, the creative industries sector contributed £109bn, equivalent to 5.6% of the UK economy, in 2021 (Scott, 2022). Beyond this fiscal imperative, there is much published research detailing the private and public benefits of the work of the creative sector to society, including pleasure, captivation, cognitive growth, the creation of social

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bonds, expression of communal meaning, improved learning skills, extended capacity for empathy, the development of social capital, and improved health (McCarthy et al., 2001, p. xiii). The creative industries and their products and services are embedded into Western society and have been affected alongside all aspects of livelihoods and pastimes with the relatively recent digitalisation (and often monetisation) of work, home, relationships, and leisure, in what is sometimes referred to as a Fourth Industrial Revolution (Davis, 2016). In addition, the COVID-19 pandemic has shown the need for improved data and digital skills, including the development of expertise around how to innovate and take products and services to market to ensure income flow and generation. In the creative and cultural sectors, online and other digital markets and platforms have proved essential for revenue generation and have provided a means to reach and engage audiences, supporting arts, culture, and heritage and allowing them to contribute to wider society.

The aim of this edited collection is to specifically examine how the creative industries can be best supported to make use of data-driven innovation and digital technology opportunities. How are the creative industries dealing with the increased digitalisation of society, and how are they embedding this in their practice? What opportunities are there for those in the creative sector to embrace, embed, and drive data-led innovation in creative activities? Moving beyond only using the platforms and approaches provided by the technology sector, what can we do to facilitate collaborative working across industries, to research and innovate where data infrastructures and approaches meet creativity? Taking a necessarily global perspective, this text aims to advance our knowledge of the ways data-driven approaches to the creative industries create challenges and opportunities in different contexts, and in turn, this text aims to contribute to research and practice by unifying and linking these interdisciplinary, and cross sectoral, issues.

Defining the data-led creative industries

It will be useful to set out some core terms, particularly regarding the creative industries, and what we mean by the terms constituting data-led innovation, in order to situate the reader, given there is wide-ranging interest in this topic from different perspectives, including practitioners, employers, policy makers, and governments.

The creative industries

Despite the contributions the creative arts make to society, definitions of the creative industries are notoriously elusive: "There is no universal definition of cultural and creative sectors. Each country has its own definition and produces different types of statistics relating to cultural participation, cultural and creative employment, and other factors" (OECD, 2022). It is,

of course, necessary to define them in order to identify, classify, and assess their various values, as well as to provide recommendations for how they can be supported and encouraged, particularly as they are often presented as a means of economic regeneration and growth (Bagwell, 2008). Although hugely successful in raising the profile of the creative industries, such economic reporting represents "differing cultural agendas, definitional agendas" (Roodhouse, 2011). In addition, Galloway and Dunlop (2007) critique any such economic value-led identification and grouping of the "creative industries," arguing that such a concept erodes the broader value of culture for the public good.

The UK's approach to defining what is meant by the term "creative industries" demonstrates the inherent complexities of this activity. By 1998, the UK's Department for Culture, Media and Sport defined the creative industries as "those industries which have their origin in individual creativity, skill and talent and which have the potential for wealth and job creation through the generation and exploitation of intellectual property" with a rubric comprising nine subsectors: 1) advertising and marketing; 2) architecture; 3) crafts; 4) design and fashion; 5) film, TV, video, radio, and photography; 6) IT, software, and computer services; 7) publishing; 8) museums, galleries, archives, and libraries (GLAM); and 9) music, performing arts, and visual arts (DCMS, 2001, p. 5). A similar approach has been adopted by several other nations wanting to assess the impact of this cluster of related industries on their economies (OECD, 2022). There are, however, other ways to consider the creative industries. Wales uses the definitions of the UK, but recent policy and delivery, via Creative Wales, have focused on the film and TV, music, and digital sectors (Elis-Thomas, 2020). Scotland, despite being a constituent country of the UK, has its own definition, with the Economic Strategy identifying "Creative Industries as a growth sector where Scotland can build on existing advantages to increase productivity and growth" (Scottish Government, n.d.), stating that the

> Creative Industries sector is made up of 16 distinct industries . . . 1) Advertising, 2) Architecture, 3) Visual art, 4) Crafts, 5) Fashion and Textiles, 6) Design, 7) Performing arts, 8) Music, 9) Photography, 10) Film and video, 11) Computer games, 12) Radio and TV, 13) Writing and Publishing, 14) Heritage, 15) Software/electronic publishing, 16) Cultural education.

In contrast, Northern Ireland defines 13 sub-sectors of the creative industries: 1) advertising, 2) architecture, 3) arts and antiques, 4) computer games, 5) crafts, 6) design, 7) designer fashion, 8) film, 9) TV and radio, 10), music, 11), performing arts, 12), publishing, 13), and software/digital media (NI Direct, N.D). Support for the creative industries in Northern Ireland has a particular, dominant, and world-leading focus on the screen industry, supported by Northern Ireland Screen (2018).

Likewise, other international nations include or exclude different industries when they set out to define the activities of the creative industries (see OECD, 2022 for an overview) and may choose particular areas to concentrate resources and support upon that are relevant to their regional economies, skillsets, and ambitions. In comparison, the United Nations prefers to consider the creative economy at large, taking a more holistic view in order to understand the interrelation between creative people and the creative content they generate, considering economic growth, employment, trade, innovation, and social cohesion, including aspects of cultural identity, economic aspiration, social disparities, and technological disadvantages (United Nations, 2008).

This absence of consistent frameworks for deciding what is or isn't a creative industry results in inconsistent data collection about their activities and so complicates subsequent analysis. Choices made regarding definitions can affect resultant public policy interventions (Galloway and Dunlop, 2007). Oman and Taylor (2018) critique non-rigorous data-led approaches, which are used for selective advocacy, although there are questionable claims for authority, with resulting problematic real-world impacts upon policymaking and funding decisions. There are also difficulties in deciding who and who is not a worker within the creative industries. Creative employment can be defined as both "occupations in the Creative Industries and creative occupations in other industries" (Comunian et al., 2021), further complicating identification and understanding the bounds of creatives and the creative workforce, which is particularly problematic when identifying and supportive freelancers or small to medium enterprises, which make up their majority (Easton and Beckett, 2021). As a result, defining, data capture, and subsequent analysis regarding the creative industries must be done with care (see Chapter 3 for an overview of data collection about the creative industries and its complexities).

However they are defined, the creative industries are impactful and expanding and are a larger and more economically successful sector than they are often given credit for. The UK's Creative Industries Policy and Evidence Centre (PEC)'s 2023 report, *The State of Creativity*, quotes DCMS statistics demonstrating that "the Creative Industries accounted for 2.3 million jobs [in the UK] in 2021 . . . and their gross value added (GVA) increased by 41.4% in real terms between 2011 and 2019, more than 2.5 times that achieved by the UK economy as a whole" (Bakhshi, 2023, p. 9). Despite this, UK Conservative government rhetoric continues to undermine the creative industries and the many contributions they make to society – see, for example, the "Rethink Reskill Reboot" 2020 campaign and the resulting backlash against a government-backed advert suggesting a ballet dancer should retrain in cyber security (Jordan, 2020), which directly pitted technology against the creative industries rather than demonstrating their co-dependencies. The lack

of interest in or support for the global success of the UK's creative industries led to a 2022 inquiry from the House of Lords' Communications and Digital Committee. The resulting report, *At Risk, Our Creative Future* (Communications and Digital Committee, 2023), called for action to maintain the UK's world-leading position in the creative and cultural sectors in the face of international competition. It was clear from the results of this inquiry that digital, data-led, and technological futures are seen as the main way that the creative industries can currently innovate and that the digital market is perceived to be global. A Creative Industries Sector Vision followed from the Department for Culture, Media, and Sport in July 2023, "As technology increasingly infuses the Creative Industries, our competitive advantage in both sectors means this country has an unparalleled opportunity in the decades ahead" (Sunak, 2023). The term "CreaTech" is now being used to describe the intersection of creative skills and emergent technology (Tech Nation, 2021), and the nature of innovation with data and data-driven technologies in the creative industries deserves further consideration as a stand-alone, timely topic.

This book aims to look at this nexus between data, digital, and the creative industries. What, then, is our own definition of the creative industries and the framing approach we take in a book which ostensibly explores them? Our editorial approach is to necessarily take a pragmatic, critical, and broadly framed view, which encompasses the production of novel goods, experiences, products, and services via creative practice and creative endeavours without being too prescriptive ourselves. Although we are driven in part by the funding context within which we are situated (operating as we are within the UK and Scottish systems, with an eye to the European and wider international context), we must sit with the various complexities in how the sector, or industry, is defined to discuss, elucidate, and critique the role of data within this space. We acknowledge the definitions delineated by others, and each chapter, in its own way, pokes a stick at these boundaries and complexities, with fruitful results and recommendations to help others navigate both economic and social issues that arise when trying to group such disparate, and often different, activities within one purview.

Data

What, then, do we mean by data?

> A collection of data can be thought of as a set of values for some variables, acquired originally by measurements of some kind. Under an appropriate interpretation, data counts as information, and information processing can refine (relatively) raw data and make it useful, by capturing, transforming and communicating it.
>
> *(Speed and Oberlander, 2016, p. 2)*

Nowadays, we mostly presume data to be digital: in modern information systems, data is represented by a string of binary data that uses only two symbols, 0 and 1, which has been captured, created, and stored in some way. The digital paradigm extends to the "use of binary logic to control machinery and encode instructions for devices, and of binary codes to transmit information" (Ceruzzi, 2012, pp. x–xi). Digital data can be transformed into relevant information via processing, and its value depends on content and use (Rowley and Farrow, 2000, p. 7). This gives rise to three different types of values: the inherent measurements contained within the data; the new commercial or social values that can be created by aggregating any kind of data, in order to increase individual or collective utility; and the set of moral and ethical values reflected in the way the data is handled, transformed, and published (Speed and Oberlander, 2016, p. 2). See Ceruzzi (2012) for an overview of digital information systems and Rowley and Farrow (2000) for an exhaustive discussion on the relationship between data, information, and knowledge.

Those in the creative professions have their own business models, history, and journeys in relation to digitalisation, and their use, adoption, and handling of data is individual to them. The range and forms of data is as varied as the collective. There are a few organisations and individuals that have mastered data-led approaches, regularly innovating with data. Yet there remain many practitioners, small and medium-sized enterprises (SMEs), and creative and cultural organisations that have struggled to keep pace with the changing data environment and to support the upskilling of their communities (see Chapter 4). The positive benefits and new possibilities of confident data handling within the creative industries could bring many opportunities for both economic and social benefits, but there needs to be support and encouragement for both the creative industries and technology providers to inform, experiment, explore solutions, research, and innovate to develop data-related skills, products, and services.

Innovation[1]

This text is primarily interested in how data can be used in innovation contexts. What, then, do we mean by innovation? At "the highest level, innovation can be defined as *making something new that creates value*" (Ottinger, 2021). In their formative paper on creativity in business, Cox and Dayan (2005) contrasted creativity and innovation, arguing:

> "Creativity" is the generation of new ideas – either new ways of looking at existing problems, or of seeing new opportunities, perhaps by exploiting emerging technologies or changes in markets.
>
> "Innovation" is the successful exploitation of new ideas. It is the process that carries them through to new products, new services, new ways of running the business or even new ways of doing business.

> "Design" is what links creativity and innovation. It shapes ideas to become practical and attractive propositions for users or customers. Design may be described as creativity deployed to a specific end.
>
> *(p. 2)*

The Oslo Manual (the international reference guide for collecting and using data on innovation, providing the basis for the Organisation for Economic Co-operation and Development[2] and others to collect and publish statistics on business innovation) chooses to combine the second and third of these in its definition of innovation as:

> a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process). This definition uses the generic term "unit" to describe the actor responsible for innovations. It refers to any institutional unit in any sector, including households and their individual members.
>
> *(OECD and Eurostat, 2018, p. 20)*

The Oslo Manual categorises business innovation into two types: product and business process.

> A product innovation is a new or improved good or service that differs significantly from the firm's previous goods or services and that has been introduced on the market.
>
> A business process innovation is a new or improved business process for one or more business functions that differs significantly from the firm's previous business processes and that has been brought into use by the firm.
>
> *(OECD and Eurostat, 2018, p. 21)*

These definitions provide a basis for collecting data on how innovation is operationalised into research and development (R&D) and show how broad ranging meaningful consideration of innovation must be. The Oslo Manual provides a mechanism to examine R&D resources and activities within firms; intellectual property–related activities; workforce skills and innovation management capability; and the ability to design, develop, and adopt technology and use data. The framework also considers knowledge flows between the firm and others in the "innovation system." These include supply chain partners and research organisations such as universities, customers, and competitors. Other external factors that should be considered include regulations, governmental action to support innovation, and new technologies (OECD and Eurostat, 2018). However, as with other innovation data collection frameworks, the Oslo Manual focus is typically on larger firms with in-house

R&D teams which have access to data regarding innovative products, as these are easiest to identify and measure. In the case of the creative industries, any frameworks based largely on registered company data, as is the expectation of the Oslo Manual guidelines, are poorly adapted for sectors where 32% of the workforce is self-employed and 76% of creative industry companies worked with freelancers over the previous year (Easton and Beckett, 2021).

A second internationally influential R&D model is the Frascati framework (OECD, 2015). This defines activities as innovative if they fulfil all the following characteristics: novel, creative, uncertain, systematic, and transferable (p. 15). This fails to capture much of the innovation in, for example, software and gaming, or the spillovers from CreaTech into non-creative industries:

> the process by which activity in . . . Creative Industries has a subsequent broader impact on places, society, or the economy through the overflow of concepts, ideas, skills, knowledge, and different types of capital.
>
> *(Fleming, 2015, p. 8, see also Chapter 3)*

An example of a spillover would be the use of animation and 3D modelling in textile sample production or bridge building. The Creative Industries Policy and Evidence Centre argued Frascati's STI framing of innovation means certain creative industries sectors cannot apply for R&D Tax Credits under the UK government scheme, as this requires R&D to be in service of scientific or technological advance, which does not include work in the arts, humanities, and social sciences – those which are most closely aligned to the creative industries (Bakhshi, 2022). Siepel and Velez-Ospina found in their research that "current R&D tax credit provision is not capturing the breadth of creative industries activity that firms themselves classify as R&D, and which our data suggests is leading to innovation and growth" (2022). Bakhshi concluded that the way that we think about and define R&D is a "significant barrier that is holding back innovation investment into the arts, humanities and social sciences" (2022). Again, thinking of the place of the creative industries within these contexts demonstrates the complexities of where they are placed, and how they operate.

Innovation – Ottinger's act of "making something new that creates value" (2021) – is therefore often a poorly understood term in the creative industries and rarely conforms to linear models of product development but instead refers to often open, collaborative, and iterative processes (EKOS, 2017). The concept of innovation has expanded from a linear model of science commercialisation and R&D to a more holistic understanding of innovation that encompasses new business models, services and different means of engaging with customers (often audiences in the creative industries), and novel means of organisational or business practices (Bakhshi et al., 2008). Research suggests that the creative industries tend to be more entrepreneurial and

innovative compared to the wider economy (EKOS, 2017), despite barriers, including restricted access to R&D funding, resulting in less experimentation; lack of access to technical skills and expertise, hardware, and software as well as the time and space to undertake R&D (Bazalgette, 2017; DCMS, 2018); and a notable skills gap, particularly around intellectual property and data analysis.

We land again at the point this book addresses: the need to understand better the role of data in innovation in the creative industries. This is a particularly pressing issue following the global COVID-19 pandemic, which impacted all subsectors of the creative industries, with global lockdowns throughout 2020 bringing about sudden shifts in cultural production, delivery, engagement, user behaviours, economic flows, and markets. The legacies of this, which still linger at time of writing, stress the need for innovation with digital and data within the creative industries and the continued need to develop new technologies and services in order to support individuals, institutions, and audiences.

The products of innovation come in many guises, particularly within the creative industries. Although there tends to a be a stress on the development of novel fully fledged products and services and the importance of economic impact and potential growth (such as the figures presented in Scott (2022) and how we opened this introduction to get your attention), we also need to be cognisant of the resources needed to support the early part of the innovation pipeline. Much innovation develops minimum viable products (MVPs): "an artefact that may be incomplete in functionality of quality, but displays characteristics that allows determining its customer value" (Münch et al., 2013) rather than delivering fully fledged businesses. In addition, "Interesting innovations that *could* be fostered between the technology and creative industries may be purely imaginative, creative, beautiful, emotional, intelligent, or encouraging reflection, resilience and social or individual wellbeing" (Terras et al., 2021). The broad value of the arts and heritage has been articulated: cultural experiences help shape reflective individuals, produce engaged citizens, impact cities and urban life, improve health and well-being, and have distinctive economic benefits (Crossick and Kasznska, 2016; Terras et al., 2014). Digital innovation in the creative industries should be no different, and we wish to assure readers that this book is interested in innovation in the broadest sense rather than only valuing or prioritising work which leads to upticks in gross value added, exports, and other purely economic productivity measures. Indeed, improved use of data may be the key to understanding the activities and the successes of the creative industries, which itself opens up new considerations of value, inclusion, method, approach, and the relationship of the physical to the digital (although empirical accounts of uses of culture can be co-opted for both honourable and dishonourable means (Oman, 2021, pp. 229–263)).

Data-driven innovation

> We are now entering an era when the generation, collection, analysis and monetisation of huge volumes of data underpins the Digital Economy. The value of data comes from its use in real-time, or aggregation over long periods, to understand and predict behaviour. Whilst data has become ubiquitous, the challenges for all organisations are effectively to use this data to shape, develop and deliver innovative processes (including new digital products and services) to consumers and citizens. This is what we call Data Driven Innovation (DDI).
>
> (Edinburgh and South East Scotland City Region Consortium, 2016)

Data-Driven Innovation,[3] within the Edinburgh context, is a brand name: the title given to the innovation network operating across Edinburgh and its regions as part of the Edinburgh and South East Scotland City Region Deal[4] (the UK government programme for accelerating economic growth via investment in innovation, skills, and infrastructure across six local authorities in the southeast of Scotland, operational between 2018 until 2033). The Data-Driven Innovation programme (2018–2028) exists to support organisations in tackling challenges for industry and society through data:

> Data-Driven Innovation happens when great ideas are combined with high-speed data analytics and research expertise. Innovation through data is not new, but is increasingly driving economic growth, social change, and improvements in public services – all thanks to rapid advances in high-powered computing. Through our ability to capture flows of data and understand what they tell us is bringing better and faster capability to identify trends and behaviour across many sectors, leading to improved services for consumers and citizens.
>
> *(DDI, n.d.)*

Although we operate within this City Deal context, given our explanations of what we mean by data and what we mean by innovation, in this book, we therefore define data-driven innovation as the act of "making something new that creates value" (Ottinger, 2021) via data, centring digital information and its related infrastructures as the basis upon which to generate new commercial, social, moral, or ethical values, including products, services, methods, and insights.

Therefore, putting all our definitions together, throughout this text, we are particularly focused on data-driven innovation for the creative industries: innovation (*making something new that creates value*) that centres data and digital infrastructures as the basis upon which to generate new commercial, social, moral, or ethical values, including products, services, methods, and insights, that occurs via creative processes that focus on and emerge from the creative industries, broadly framed.

Creative Informatics

The perspective taken within this book draws heavily from Creative Informatics, an innovation programme focusing on data and digital approaches within the creative industries, which received £7.7 million funding over a five-year period (2018–2023) to support research and development (R&D) in Edinburgh and South East Scotland City Deal Region (2018–2018; see Chapter 2 for more details about the ecosystem supported during this wider initiative). Most of the funding for this initiative came from the Arts and Humanities Research Council (AHRC, grant number AH/S002782/1) as part of the Creative Industries Cluster Programme,[5] a UK-wide initiative "to drive innovation and skills, and create products and experiences that can be marketed around the world" (Creative Clusters, 2022). Creative Informatics received additional financial support from the Scottish Funding Council and Data-Driven Innovation programme (see Chapter 2 for further information). Creative Informatics is a partnership between the University of Edinburgh,[6] Edinburgh Napier University,[7] Codebase[8] (currently the UK's largest technology incubator), and Creative Edinburgh[9] (a city-wide membership organisation and social enterprise that unites and supports creatives). At time of writing (October 2023), Creative Informatics has supported 350 different entrepreneurial activities, distributing approximately £2.8 million of funding, which has resulted in a total of 29 new start-up businesses, 143 new jobs, and 180 safeguarded jobs (and counting); created 187 new products, services, and experiences; and built a network of 2900+ businesses and individuals. In addition, those entrepreneurs we have supported have attracted external funding and investments of more than £7.2 million, and £4.1 million additional in-kind contributions towards R&D projects have been attracted.

The range of activities supported by Creative Informatics would be enough to fill a book on its own, however – even though we have timed this book to be published at the close of the Creative Informatics 2018–2023 programme – we have taken care to compare our experiences from activities in Edinburgh with a more global outlook, including authorship from international collaborators, working in different economic contexts and weaving various case studies and contemporary examples of in-the-world initiatives throughout. In addition, in order to situate them, each chapter is followed by a short, real-world case study from the Creative Informatics stable, highlighting practitioner approaches and foregrounding how issues of practice and policy play out when operationalising data within the creative industries. The findings and recommendations we therefore provide here are generalised to be applicable to a wider audience than our local constituency: we hope that the range of topics covered will allow others to consider, plan, and operationalise the use of data within the creative industries for the purpose of effective and efficient innovation.

Chapter overview

Approaching data-driven innovation in the creative industries from various angles, this book consists of ten further chapters, each taking practice within the creative industries as the starting point for its own contributions. Each chapter will draw on real-world examples to explore issues including the history of initiatives supporting the creative sector to innovate, practical routes to building innovation ecosystems and partnerships, and what we can learn from these initiatives; legal and ethical frameworks, including issues of ownership and control; the role of place, location, and identity when supporting creative ecosystems; the now-global nature of platform economies and how the growth agenda fits in with public policy for the creative sectors; the need to measure R&D in the creative sectors and how we can meaningfully do that when data is concerned; models which can be used to train and upskill creative communities in data-led innovation; the globalised nature of the creative industries; issues of precarity and support when engaging SMEs in the creative industries; and sustainability and expectations of the creator economy. A common theme throughout is the changes wrought by the COVID-19 pandemic to the creative industries, including the switch to online and hybrid working, and cultural production and consumption.

In Chapter 2, Panneels et al. reflect on the ecosystems and partnerships that are required to enable data-driven innovation in the creative industries, as well as barriers that are in place to this type of support. Comparing a city (Edinburgh) and national (Welsh) contexts, the chapter reflects on the success of strategic decision and policymaking in relation to grassroots development and conversely how emerging R&D can inform policy.

Chapter 3 sees McDonald et al. describe the many issues that emerge when trying to collect accurate data about the creative industries. Though many prior research programmes have attempted to address problems in collecting, analysing, and sharing data, innovation in evaluation methods has been relatively slow to take hold. This chapter provides new policy recommendations for the creative industries to achieve better, more impactful, sector-focused outcomes.

In Chapter 4, Osborne et al. explore models for training and upskilling people in the creative industries in data, technology, and entrepreneurial skills, situating this in the wider skills and training context and presenting views on the role of digital and data literacy skills. This chapter looks particularly at the challenges of delivering training in the creative sector, where innovation and problem solving are core skills but capacity for continuous professional development is frequently limited by the nature of employment or freelancer working and existing data and business literacy.

Exploring equality, diversity, and inclusion, in Chapter 5, Black et al. ask how best can data underpin our understanding of diversity and inclusion in the creative economy? This chapter synthesises available research on the

intersection of race, class, and gender in the creative sectors and shows how data can inform our understanding of mechanisms of exclusion in creative occupations. It particularly focuses on what we know about the makeup of the data-driven cultural economy and makes recommendations on what we must do to ensure that both a diverse workforce and audience can engage in digital aspects of the creative industries.

As data and data-driven innovation continue to become increasingly important in the creative sector, complex issues of ethics, privacy, and appropriate business models are raised, particularly as AI becomes more widely adopted. In Chapter 6, Osborne et al. explore how the sector is currently addressing issues of data ethics in R&D and innovation contexts, with particular reference to issues of diversity, social equity, and the role of data in emergent business models, discussing interventions and support mechanisms that are supporting ethical innovation.

In Chapter 7, Terras et al. explore changing aspects of digital asset ownership and control, emphasising the connection between ownership technology, legal reform, and the creative industry via the Law Commission's recent suggestions on how to tackle control of digital assets. This chapter uses NFTs as a case study, highlighting a shift in digital ownership, and underlines that collaboration among researchers and creatives will be necessary to redefine digital property rights and the creative economy's future.

Chapter 8 sees Elsden et al. reflect on how contemporary data-driven and monetary technologies have begun to decentralise how creative work is valued, supported, and paid for. We consider the implications of a more distributed, automated, data-driven, and audience-led landscape for funding and paying for creative work and suggest how individual freelancers, creative organisations, and institutions can respond to and benefit from the challenges and opportunities these decentralised creative economies represent.

In Chapter 9, Vidmar et al. consider the potential impacts of working with experiential and creative AI as a mutually disruptive force in the creative industries and creative economy. A timely examination of the role of AI in the creative arts, this chapter positions AI as an engaging lens through which to explore social, cultural, political, and economic contexts of the development of machine learning technologies in the creative industries and in society more broadly.

Chapter 10 examines the 'pivot to digital' in the cultural sector during the COVID-19 pandemic, exploring continuing impacts on perceptions and production of digital and hybrid live events. Jones and Elsden evaluate methods for research in this space that can sensitively explore digital and data literacies in both cultural production and consumption and the potential of a relationship between online, offline, and hybrid programming as both an opportunity and a challenge in empowering the cultural sector and its audiences.

Finally, Chapter 11 focuses on expectations for the creative industries to be sustainable. Panneels et al. show how data-driven innovation can support the shift towards a more sustainable future, with case studies from both the Edinburgh and Barcelona contexts. Providing examples that highlight alternative methods of finance, distribution, access, and production of creative works and enterprise, this chapter demonstrates how the creative sector is moving towards economic models that expand on the notions of growth alone and include ecological, social, and cultural benefit.

We have chosen to follow each chapter with a specific case study, providing a real-world example of an R&D project that explores data in the creative industries, related to individual chapter themes. The project we have chosen to feature as a case study for this introduction, TouchLab, is undoubtedly Creative Informatics' most successful from a financial perspective but also shows the benefits of interdisciplinarity and sector spillovers in the marrying of fashion, technological innovation, and robotics: perhaps something we would not have expected at the start of our innovation journey.

Editorial approach

Chapters have been edited to avoid including repetitive definitions of the creative industries or their data-led approaches: it is the place of this introduction to provide an overview to the reader on our shared understanding of these terms. To avoid confusion between the capitalised Creative Informatics (CI) programme, which has the same acronym as can sometimes be applied to the creative industries, we have used the acronym only in application to Creative Informatics, and 'creative industries' appears in lowercase unless part of a title or name. Similarly, when referring to data-driven innovation, this will only be capitalised if referring to the Data-Driven Innovation programme through which Creative Informatics is partly funded.

Many of the materials and resources referred to as case studies within the chapters are prototypes, minimum viable products, blog posts, or white papers: by their nature, the majority of these tend to be ephemeral or short lived. We have therefore asked all authors to preserve all links to online resources they mention by placing them within the Internet Archive (archive.org), which will provide a useful resource to future readers. Given many products, initiatives, organisations, companies, and government bodies change names in this rapidly moving space, we have been careful to use their name at the date of cited activity rather than their current incarnation at time of publication. Throughout, we will be looking towards the practices of creative practitioners and ramifications for those supporting them, in part to ensure that the content of this volume does not become rapidly dated around particular technologies and technological interventions but concentrating instead on building data capabilities and what is being done, worldwide, to

ensure that creatives can fully engage in, respond to, and thrive within the inexorable rise of a digitised society.

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Conclusion

This book represents a novel intervention that directly addresses the concept of innovation within the creative industries, uniquely centring the role of data. Although many aspects of innovation are economically driven, we also elucidate areas of potential social good: an area that is under-described in previous literature. We believe our practice-led, case study approach captures both a snapshot regarding current areas of development in the creative industries but also wider issues concerning the global information environment and how to innovate successfully within it.

Given that the focus of our text concerns the digitalised, we are delighted that this book is also available for free digital download. The editors wish to thank all chapter authors for their contributions – to both the book and to the wider programme – and the AHRC (grant number AH/S002782/1), Scottish Funding Council (grant number H19025/SIRL ID: 1659), and the Data-Driven Innovation programme for the funding that made our research, and this resulting open access book, possible.

Notes

1 This section of the introduction was co-authored with Caitlin McDonald, University of Edinburgh.
2 https://www.oecd.org
3 https://ddi.ac.uk/
4 https://esescityregiondeal.org.uk
5 https://creativeindustriesclusters.com
6 https://www.ed.ac.uk
7 https://www.napier.ac.uk
8 https://www.thisiscodebase.com
9 https://creative-edinburgh.com

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CASE STUDY

Like being there: how Touchlab uses robot avatars with the revolutionary ability to touch to facilitate remote healthcare

Founded in 2018 by Dr Zaki Hussein, Touchlab is a start-up with a young culture based at the Higgs Centre for Innovation in Edinburgh. The company is focused on building and developing the future of sensing technology or electronic skin (e-skin) to allow machines to possess the sense of touch. Rather than just supplying an e-skin, Touchlab designs systems to integrate the sensing technology into any surface and additionally develops the software and visualisers around it.

This e-skin, which is thinner than human skin, is effectively wrapped around a robot to allow it to touch. Machines fitted with e-skin can roll pens, grasp soft objects, and detect slip, even in extreme conditions such as acid, high and low temperatures, and radioactive environments, opening up huge potential for its use, including in space exploration.

In 2020, Touchlab applied to be a Creative Informatics Resident Entrepreneur, looking to add expertise in software AR and VR integration into the team's skill set to design an intuitive 3D/AR interface and further the development of a tele-operated avatar system, Nexi, which would be able to gather huge quantities of sensory data. This avatar system, which comprises a robot, VR and AR systems, and Touchlab's hallmark e-skin in a single operator-controlled system, will essentially allow an operator to see, hear, speak, and feel through a robot, regardless of their location within 400 km, which would allow specialist and high-quality care to be easier to dispense and allow healthcare providers to spend less time fulfilling basic operations, therefore reducing the strain on healthcare systems. Though the existing team had already started building the robotic system and integrating the first sensors, work was still required to translate all this data to a controller. Bringing the systems together via this expertise would increase the quality and effectiveness of their equipment demonstrations, an essential sales tool for technology of this nature.

Touchlab aimed to achieve the goals of this project in a creative way, for instance, using synaesthesia. For example, a medical avatar evaluating a patient fever could translate to the controller the heat on the fingertips, see the temperature rise on the headset or even smell the high temperature of a patient as a scent. To manage this, both an experienced software developer and 3D graphics programming developer would be required.

The output of this work was included in an entry to the ANA XPrize Avatar competition in 2021,[1] a four-year global competition, offering a prize purse of $10 million, focused on the development of an avatar system that will deploy

a human's senses, actions, and presence to a remote location in real time, leading to a more connected world. Of the 77 qualified teams, 38 were selected as semi-finalists, and 15 as finalists, of which Touchlab was one, presenting its work at an event in Miami, Florida.

Though finding new talent with the highly specialised and in-demand skills needed proved a challenge, particularly in the face of COVID-19 and Brexit immigration restrictions, Touchlab managed to on-board two new team members (one part time and the other full time). This team had the knowledge and experience needed to translate data from the robot avatar to a controller VR headset, force-feedback gloves, and force-feedback suit. The funding additionally allowed other team members to dedicate more time to upskilling and developing their knowledge of creating virtual environments.

Equipment purchased with Creative Informatics' Resident Entrepreneur funding enabled the acquisition of a Robotiq gripper, which was mounted to the avatar to facilitate delicate grasping and make possible tasks such as plugging a charger to a socket. A VR headset pack was also purchased, and the company was also able to finance a force-feedback suit (Teslasuit) – all of which increased the feel of immersion into the virtual reality world for the avatar operator. As with many other Resident Entrepreneurs, the mentorship provided by the programme was particularly praised by Touchlab for helping team members to find their voice and develop ways of effectively communicating across the team and beyond.

Touchlab has received significant co-investment from Scottish Edge (£100,000), Scottish Enterprise (£25,500), and TechStart Ventures Scotland (£600,000). In early 2022, it received a £3.5 million investment from Octopus Ventures, one of Europe's largest and most active early-stage investors, to expand and accelerate its work by strengthening its commercial and tech teams to better meet the increasing demand for its visionary product and its myriad potential uses. In 2023, they were placed at number 41 of Startups' 100 Index.[2]

In early 2023, Touchlab began a real-world pilot of its technology within a hospital environment, deploying its robot and e-skin technology within a geriatric acute ward in Finland. Though currently focused on medical deployments of the equipment, Touchlab believes that the creative industries could benefit from its technology across a range of scenarios, including providing more inclusive and interactive ways of experiencing museum collections and stage shows, particularly for those with access or sensory needs or who may not be able to easily travel outside of their living environment, transforming live video performances into full sensory experiences.

There can be no doubt that we are at the very beginning of the exploration, development, and implementation of tactile technology and that its

transformative impact on a wide range of areas will only become more apparent as further products are developed and pilots are tested across environments and scenarios. All signs are that Touchlab will continue to be at the forefront of these exciting developments.

Victoria Murray

Further information

Website: https://www.touchlab.io/
TechCrunch news feature: https://techcrunch.com/2022/10/14/touchlab-to-begin-piloting-its-robotic-skin-sensors-in-a-hospital-setting/?guccounter=1
Telerobot Avator demonstration: https://www.touchlab.io/telerobotavatar

Case study notes

1 https://www.xprize.org/prizes/avatar/finalist-teams
2 https://startups.co.uk/startups-100/2023/touchlab/

2

ECOSYSTEMS AND PARTNERSHIPS

Enabling factors for data-driven innovation in the creative industries

Inge Panneels, Candace Jones, Caroline Parkinson, Marlen Komorowski, and Anna Orme

Abstract

What are the ecosystems and partnerships required to enable data-driven innovation to be taken up in the creative industries? This chapter discusses how ecosystems enable different forms of innovation through partnership networks in the creative industries. Case studies from Edinburgh and the southeast Scotland region, and Wales, demonstrate how online and in-person ecosystems can be enabled and how strategic partnerships can support innovation in the creative industries. The chapter analyses what impact small industry–focused research and development grants can have on ecosystems and what barriers are observed. It reflects on the effect of strategic decision and policymaking in relation to grassroots development and conversely how emerging R&D can inform policy.

Introduction

What is the role of ecosystems and partnership networks in the development of data-driven innovation in the creative industries? We argue that the prevalence of a 'network model of governance' typifies the creative industries and is critical to support innovation in the creative industries. In this chapter, we posit that data-driven innovation in particular relies on strong ecosystems to support interdisciplinary partnerships to develop and provide case studies on a regional (southeast Scotland) and a national (Welsh) initiative to demonstrate their ecosystem's activities, reach, and impact. Furthermore, we argue that the idea of the network is critical to understanding data in the context of innovation and that it is imperative to support such networks if we wish to see growth in the use of data within the creative industries.

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Creative ecosystems

The creative industries, as "those industries which have their origin in individual creativity, skill and talent and which have the potential for wealth and job creation through the generation and exploitation of intellectual property" (DCMS, 2001, p. 5; DCMS, 1998), can also be understood as *creative ecologies*. This includes the wider *creative ecosystems*, of funders, support structures, and organisations which provide the development support to creative and cultural ecosystems via a multitude of interconnections and interdependencies (Gross and Wilson, 2019; De Bernard et al., 2021; Komorowski et al., 2021b). In this chapter we argue that the creative industries, understood as a creative ecology, relies on a "network model of governance" (Jones et al., 1997, p. 911), a concept from business studies which refers to distinct forms of exchange, communication, coordination, and collaboration between businesses. The social mechanisms in network governance have been demonstrated to reduce transaction costs, which leads to comparative advantage over markets and hierarchies.

> Network governance involves a select, persistent, and structured set of autonomous firms (as well as non-profit agencies) engaged in creating products or services, based on implicit and open-ended contracts to adapt to environmental contingencies and to co-ordinate and safeguard exchanges. These contracts are socially – not legally – binding.
>
> *(Jones et al., 1997, p. 914)*

The film industry, for example, has been cited as a primary example of network governance (Jones et al., 1997, p. 916), but it typifies the creative industries at large. The network governance model has found traction in creative industries research, which in recent years has moved from an economic model to take a more ecological approach in which social network values are critical.

The creative industries sector is made up predominantly of micro businesses (less than ten staff) (94%) (Creative Industries Council, 2021; DCMS, 2018a) and has a significant proportion of sole traders (32%) (Easton and Becket, 2021), a trend which is also emergent in the wider economy. Research has demonstrated that creative industries, partially because they are dominated by sole traders and micro businesses, tend to co-locate in *creative clusters* of diverse, specialised creative businesses that rely on access to specialised labour and skills (Chapain et al., 2010; Chapain and Sagot-Duvauroux, 2020; Siepel et al., 2020). *Creative networks* are mechanisms that support the heterogeneous, largely freelance creative workforce within creative clusters. These networks are critical nodes in creative ecosystems which are as much geographically as they are socially defined and have been proven critical in supporting sustainability in the creative industries (Bakhshi et al., 2013;

Komorowski et al., 2021b). Further research (Komorowski et al., 2021b) has highlighted the *value network* which emanates from local creative networks across regional creative ecologies. The networked nature of a nimble predominantly freelance and micro business creative workforce has a responsiveness which enables it to be flexible in a volatile and uncertain marketplace. This amorphous, flexible nature of the creative industries relies on the social capital of creative ecologies as demonstrated by the model of governance. Therefore, the existence and proximity of a creative cluster, creative networks, and other creative ecosystems are critical to sustain a creative ecology.

In this chapter, we argue that a creative ecology enables access to trusted collaborators, shared risk, and common understandings that support creative and research and development (R&D) processes and underpins data-driven innovation in the creative industries. The subsectors of the creative industries share common R&D challenges, so resolving these benefits the sector more widely.

Innovation in the creative industries

The recent digital transformation of the economy (Schwab, 2015; Davis, 2016; Xu et al., 2018) has been overhauling the creative industries by enabling a vast increase in available digital content, new entrepreneurial dynamics in online markets, and new business models (Benghozi and Paris, 2016; DCMS, 2018b). During the period of global COVID-19 lockdown, five years of digital adaptation was condensed into two months (Baig et al., 2020). This significantly accelerated the shift towards digital adaptation, and the cultural and creative sector became a proving ground for data-driven innovation.

Innovation is often a poorly understood term in the creative industries (Nesta, 2008) and rarely conforms to linear models of product development but instead refers to often open, collaborative, and iterative processes (EKOS, 2017). In Scotland, an EKOS report (2017) noted that creative enterprises experience higher barriers to innovation because higher education institutions' one-size-fits-all approach is mismatched with the diversity of the creative sectors (EKOS, 2017). The EKOS report identified three areas of innovation: 1) technology innovation, 2) business model innovation, and 3) creative (aesthetic) innovation. Although successful innovation in the creative industries often includes innovation in each of these areas, it is the combination of creative, technological, and business skills, as well as data literacy (Parkinson, 2020), that is key to data-driven innovation (see also Chapter 4). Data has always informed creative product design and development: for example, development of prototypes, user testing, market research, community engagement, and so on. However, it has been argued that creatives need to understand better how to design from, with, and by data (Speed and Oberlander, 2016).

Our experience of working with creatives on data-driven innovation has demonstrated that innovation is often unrecognised by creative companies themselves as they create and solve problems 'on the go' iteratively and often do not consider, or label, this process innovation, echoing the observations made in the EKOS report (2017). This in turn often makes it invisible to researchers and policymakers. The value of networks is that recognition by others can take place. An enabling ecosystem can also appear invisible to those who may find themselves supported from within it. This suggests to us that networks and ecosystems are a critical part in the process of innovation as they support, connect, and make visible the innovation taking place in the creative industries.

Financial and knowledge support are critical to innovation in the creative industries. As noted earlier, the creative industries remain dominated by freelancers and micro businesses, with limited human and financial resources to undertake R&D. In Scotland, schemes such as Innovation Vouchers were proven to be a successful mechanism for creative businesses to provide access to academic expertise up to the value of £5000, which resulted in knowledge transfers, supporting innovation and increased networks (ibid). It is notable that there was a sizable take-up from the creative industries: (18% in 2019/20 and 21.5% 2018/19) (Interface, 2018–2019, 2019–2020), which, given the scope of industries in Scotland, is a significant proportion of innovation funding driven by the creative industries. The provision of financial incentives has been proven to support the growth of a creative innovation ecosystem, as outlined previously, but the lack of follow-up funding was identified as a key barrier for further development (ibid). However, we contend that small seed funding initiatives, such as Innovation Vouchers, are important enablers of innovation, as supported by evidence from our two case studies, but that this relies on a network of governance.

The role of organisations that provide support and resources for growth-oriented entrepreneurs in entrepreneurial ecosystems has been well documented (Bakhshi et al., 2008; Spigel, 2016) and relies on supportive policy provision, in this case the UK Industrial Strategy (2017), written in response to the UK exiting the EU. Understanding where and how creative ecosystems and clusters exist has been the subject of various mapping exercises, such as the UK map[1] created by the Policy and Evidence Centre (PEC) (Siepel et al., 2020).

In the following we discuss the importance of creative ecosystems to support data-driven innovation R&D and provide evidence of how the emergence of creative innovation ecosystems supported access to further network expansion and, critically, access to follow-up funding. We demonstrate this with illustrative examples from two cases from Scotland and Wales, two comparable small nations in the United Kingdom whose creative industries have been identified as key economic drivers (Scottish Government, 2019; Welsh Government, 2020). We present a regional approach (Case 1: Creative

Informatics in the Edinburgh and the southeast Scotland region) and a country-wide approach (Case 2: Clwstwr, Wales) and particularly look at the role of ecosystems and networks which resulted from these investments in the local innovation clusters. Creative Informatics and Clwstwr are part of the Creative Industries Clusters Programme (https://creativeindustriesclusters.com) (CICP) (UKRI, 2018) which was developed in response to the UK Industrial Strategy (2017) and funded by the Arts and Humanities Research Council's (AHRC) Research, Development and Innovation (RD&I) fund. We outline how targeted investment in creative clusters has not only resulted in the growth of regional creative businesses but, critically, has resulted in the growth of local creative ecosystems, seen in expanded networks, increased collaborations, and further investment in the region. We identify how the resulting creative ecosystem has supported innovation and data-driven innovation in particular.

Case 1: Creative Informatics, Edinburgh, Scotland – regional approach

In the Edinburgh and Southeast Scotland City Region (ESESCR) (https://esescityregiondeal.org.uk/about-us), deliberate enabling steps have been taken to create a focus on data-driven innovation for economic growth in the region. The University of Edinburgh conducted a Science & Innovation Audit (Department for Business, Energy and Industrial Strategy, 2016) which identified growth potential in data-related activity in ten sectors as well as the skills, needs, and jobs that would be required to meet that growth. This informed the ESESCR City Deal, a capital investment led by the UK government and supported by the Scottish Government (ESESCR, 2018) of £1.3bn to develop and strengthen a regional economic cluster by investing in innovation, skills, and infrastructure over 15 years in an area which comprises 26% of Scotland's population. This includes significant investment in research, development, and innovation across all industries but includes specific investment in the creative industries. The Scottish Government (2007, 2019), like its UK counterpart (UK Government, 2017), recognised the creative industries as one of seven key growth sectors for Scotland and acknowledged that the "combining of technical and creative skills, collaborative working across and beyond the sector, entrepreneurialism, social enterprise and revenue generation" (Scottish Government, 2019, p. 2) play an increasingly important role in economic, social, cultural, technological, and environmental transformations. The aforementioned map of creative clusters in the UK (PEC) (Siepel et al., 2020) offered evidence of a creative cluster in Edinburgh and highlighted a cluster in Galashiels, southeast of Edinburgh. The PEC mapping, however, did not have enough granularity to identify the rich ecosystem of creative micro business, later evidenced in the map created by the South of Scotland Enterprise development agency (SoSE) (EKOS, 2022).[2]

The University of Edinburgh proposed and partnered in the City Deal with the City of Edinburgh Council to create and deliver the Data-Driven Innovation (DDI) Programme over 15 years from 2017, building five hubs to focus on data-driven innovation research, education, entrepreneurship, and innovation with industry. The Edinburgh Futures Institute is the data-driven innovation hub for the creative industries and four other sectors. In this context the enabling ecosystem has focused its energy and resources on data-driven innovation, providing skills, education, research and innovation collaboration, and entrepreneurial support. In this setting, the Institute of Design Informatics within the University of Edinburgh proposed the Creative Informatics Cluster programme in response to the AHRC Creative Clusters Programme funding opportunity in 2018, deliberately designing their proposal to align with this wider commitment and allow for direct engagement and support with and for the creative industries to develop data-driven innovation. The DDI programme has also developed a Skills Gateway to support data skills training, as well as a Data-Driven Entrepreneurship programme and AI Accelerator to which creative innovators, including Creative Informatics participants, can apply.

Creative Informatics (CI), which emerged from these policy directions, has contributed to the emergence and growth of an innovation ecosystem and the longer-term structures and partnerships which have been put in place to sustain ecosystem support beyond the duration of the funded cluster programme. Creative Informatics received £7.7 million funding over a five-year period (2018–2023) to support R&D in the creative industries in ESECRC, mostly from the Arts and Humanities Research Council (AHRC) as part of the Creative Clusters programme. It delivered this through a multi-faceted approach to R&D that supported 1) a programme of *outreach* events (Example 1.1), 2) the investment in *physical infrastructure* (Example 1.2), 3) a *start-up programme*, and 4) a programme of strategic *investment in R&D funding* streams (Example 1.3).

Over the period of investment, Creative Informatics has supported an *outreach programme* which included over 70 networking events: 23 Labs (primarily short talks of examples of creative technologies), 22 Studios (exploratory hand-on workshops), four Partnership Forums (community feedback sessions), and four Annual Showcases (demonstrating good practice from within the CI community and external examples of creative technology innovation and several launches), including a sustained programme of networking events during the period of lockdowns (12 Friday Forum and two online Annual Showcases).[3] These events introduced creatives to existing and inspiring role models of data-driven innovation within their industry by targeting a particular creative audience (e.g., focused on music, dance, craft, performance, etc.). During the global pandemic, online digital platforms (Mighty Networks, HeySummit, and Vimeo) were used to deliver the annual Showcase, in turn innovating in how networking events could be delivered

online and advising others in this space (Chan et al., 2022). As demonstrated in our example (1.1), these networking events were crucial to introduce creative businesses and organisations to each other and often led to multiple collaborations and partnerships, with the network acting as catalyst.

Example 1.1: Think Plastics, Applied Arts Scotland

Three craft practitioners used Interface's Innovation Voucher scheme in 2019 to access academic expertise to explore biodegradable plastics and develop sustainable plastics, working with a materials expert at Edinburgh Napier University, a chemist at the University of Edinburgh, and a biologist at Royal Botanical Gardens in Edinburgh (RBGE), resulting in the *Think Plastics* (https://www.rbge.org.uk/news/articles/artists-and-scientists-working-together-to-showcase-plastic-in-a-new-light/) exhibition at the RBGE in spring 2020. This led to a further Innovation Voucher being accessed by one of the craftspeople to develop a new compostable plastic using clay dust. Furthermore, Creative Informatics collaborated with the craft makers and the RBGE to host two networking events, which in turn led to the establishment of the Closing the Loop (https://www.appliedartsscotland.org.uk/projects/closing-the-loop/) network of craft makers in collaboration with Applied Arts Scotland to explore circular economy principles (Panneels, 2023). Applied Arts Scotland, in turn, then successfully applied for Creative Informatics funding to support the use of VR for remote collaboration (Panneels et al., 2023).

This demonstrates that Creative Informatics is operating and interacting with external network opportunities and that projects can successfully navigate this wider ecosystem and the role of the outreach programme to connect creatives to the innovation networks.

A further 80+ Creative Informatics events supported the creative community with discovery workshops, Q&A sessions, or studios to give much more tailored support for individuals. In total these events engaged with over 5,000 participants and were key for creative businesses to understand what data-driven innovation might mean for them, and more importantly to find potential partners and collaborators: the enhanced social capital on which the network of governance relies.

Creative Informatics has also seen investment in *physical infrastructure* in two key physical spaces: Inspace (University of Edinburgh) and E11 (Edinburgh Napier University). Inspace has supported a series of events such as the hosting of CI Labs, symposia, and various exhibitions, including Pip Thornton's *Newspeak* (2019) (Example 1.2) during the 2019 Edinburgh

Fringe (Thornton, 2022) and the *There Be Dragons* (https://inspace.ed.ac.uk/coming-soon-exhibition-there-be-dragons/) exhibition, which showcased work by artists exploring what data is.

Example 1.2: Pip Thornton and Ray Interactive

Artist and academic Pip Thornton had been introduced to creative design studio Ray Interactive as the hosts of the first CI Labs in early 2019. Thornton worked with Ray Interactive on *Newspeak* (2019) (https://www.designinformatics.org/news/newspeak-2019/), which visualises the words of George Orwell's *Nineteen Eighty-Four* as if they were commodities on a stock exchange. Using live data scraped from Google Ads, the text of the book scrolls across the facade as tickertape using the projection capabilities at Inspace. The fluctuating prices of the words are determined by what they are worth to Google in the context of an advert. Thornton continues to work with Ray Interactive on various projects. In turn Ray Interactive have worked with several other CI community members: (*Tidesong* (https://victoriaevans.space/tidesong/) by Victoria Evans, and *Atmosphere* (http://www.mediascot.org/atmosphere) by New Media Scotland), delivering the tech component of creative projects.

Access to these spaces enabled experimentation and testing of new ideas by the CI community. The purpose of the E11 studio is to support the local creative industries by providing space and access to specialist equipment, including specific technologies requested by creatives to prototype and investigate new opportunities. The programme of Studios was to be delivered in these spaces but had to pivot online during the pandemic: an introductory workshop in animation, for example, was successfully delivered online using tablets or smart phones. However, online Studios were not always appropriate, as this strand relied extensively on the ability to try out new technology and equipment not normally available to creatives, such as AR or VR headsets (Panneels et al., 2023), specialist sound equipment, or 3D scanning tools.

The Creative Bridge start-up programme (https://creativeinformatics.org/creative-bridge/) was a creative industries accelerator delivered by tech ecosystem support organisation CodeBase. It supported ten cohorts, totalling 220 creative entrepreneurs, to explore data-driven innovation in their business, introducing start-up thinking playbooks and processes. The programme has supported new and emerging businesses and partnerships across the creative sectors like Boom Saloon (https://www.boomsaloon.com), a print magazine democratising print; Busking Pro CIC (https://busk.co/blog/about/), providing street buskers with digital services from online payments to selling

their music; Tinderbox Collective (https://tinderboxcollective.org), developing software to enable two acoustic pianos to perform live duets remotely; or Scottie,[4] who developed a ticketing service tailored to creative producers. Key to this programme was the ability to network with others when meeting weekly in person or online during COVID-19 lockdowns.

The programme of *R&D funding schemes* supported various schemes, but three are of particular note: the Connected Innovators, Resident Entrepreneur, and Challenge projects. The Connected Innovators programme (https://creativeinformatics.org/connected-innovators/) was delivered in partnership with local network Creative Edinburgh,[5] an industry-facing network of over 5,000 members, which supported mentoring and funding of 27 creative practitioners. Feedback from the participants overwhelmingly noted that access to the network and the networking facilitated by Creative Edinburgh was a critical part of their success. Creative Edinburgh contributed to knowledge building surrounding data-driven innovation in the creative industries. This was achieved through the community engagement *Talking Heads* event series showcasing data-driven projects which unpacked the potential of data in creative practices. In addition, Creative Edinburgh provided expertise and upskilling opportunities to 101 people through a mentoring programme for the development of ideas, new processes, and products, including mentoring the Resident Entrepreneur scheme[6] of 74 creatives. The Challenge programme[7] supported 29 Challenge Projects which actively connected cultural and creative organisations and businesses with tech specialists. These R&D funding schemes were not just important in supporting the development of new products and services but also brought to the surface existing niche networks and connected them into a wider ecosystem, as outlined in Example 1.3.

Example 1.3: Brian Baglow and the Scottish Games Network

Brian Baglow hosted an online CI Lab[8] in December 2020 to highlight the rich ecology of the Scottish indie games industry. He also received Connected Innovator funding, managed by Creative Edinburgh, to undertake data-led research to map the industry, which he knew well through his voluntary work running the Scottish Games Network,[9] but which was not fully understood by policymakers and industry alike. Baglow's mapping work led him to connect to policymakers with briefings to the Scottish Parliament (Scottish Parliament, 2021). He also took part in the PlayAway Games Festival in February 2021 hosted by community music collective Tinderbox,[10] who also received Creative Informatics funding. See also the case study accompanying this chapter on Civic Digits.

Overall, Creative Informatics funding has led to 350 awards to entrepreneurs across the Creative Informatics programme of approximately £2.8 million, which has resulted in a total of further external funding and investments to entrepreneurs of more than £7.1 million and £4.1 million of in-kind contributions towards R&D projects, resulting in 29 new start-up businesses, 143 new jobs, and 180 safeguarded jobs (and counting). Furthermore, Creative Informatics supported six collaborative projects between higher education institutions (HEIs) and creative businesses and supported 135 inward placements by creatives to HEIs. Creative Informatics had more than 5,560 engagements with local creative businesses, in addition to 787 with non-creative businesses, thus expanding the network beyond the creative industries. It must be noted that although the geographical scope of the project extended beyond the boundaries of the city of Edinburgh, the majority of funded projects and networks have been within the city postcode boundaries, despite the increased geographical reach of the Creative Informatics programme afforded by the digital pivot enforced by the global pandemic. Beyond the economic benefits, our research has shown that this investment in the creative ecosystem in the city of Edinburgh has led to its expansion and to numerous collaborations outside of the direct scope of the Creative Informatics project.[11] The importance of networks and a supportive ecosystem are critical for a thriving innovation ecology.

Case 2: Clwstwr, Wales – nationwide approach

Wales has a long history of policy support for the creative industries. For example, in 2010, the Welsh government assisted with the relocation of Wolf Studios, one of the UK's largest purpose-built studios for TV and film production (https://bad-wolf.com/wolf-studios/) to Cardiff Bay, an initiative that aimed to attract significant high-end productions to Wales (Welsh Government, 2020). Furthermore in 2016, the UK and Welsh governments, as well as the ten local authorities in southeast Wales, launched the Cardiff Capital Region (CCR) City Deal to promote considerable economic growth in the region through investment, upskilling, and enhanced physical and digital connectivity. The creative industries are one of the City Deal's six primary target sectors (Cardiff Capital Region, 2019). In the same year, there was a manifesto commitment to establish Creative Wales, an internal Welsh government agency, to support the creative industries. Creative Wales was officially launched in early 2020, with an emphasis on the film and television, music, and digital sectors (Creative Wales, 2023). Behind the Welsh government's and other regional and local authorities' strong commitment was an understanding of the need to provide a more streamlined, adaptable, and innovative service to the creative industries, which has become an important part of the nation's economy that is quickly evolving (Welsh Government, 2020).

The creative industries, particularly the audio-visual sector, have played a vital role in Wales's economic rebirth. Cardiff, according to an independent review of the creative industries commissioned by the UK government in 2017, has become one of the UK's largest media production centres outside of London, with a strong independent TV production industry (Bazalgette, 2017). In 2018, a report published by Nesta, a British foundation with the aim to support innovation, characterised Cardiff as a city undergoing rapid creative growth, fuelled by increased dynamism in digital and media technologies, and poised to become a leader in the UK's creative geography (Mateos-Garcia et al., 2018). Research from 2019 (pre-COVID-19), identified more than 8,600 active firms and 84,500 people working in Wales's creative industries (Fodor et al., 2021). The film and television cluster, in particular, has undergone a decade of robust growth, making Cardiff the third-largest film and television cluster in the UK, after London and Manchester. There are 1,318 audio-visual media enterprises in the Cardiff Capital Region, with a total annual turnover of £545 million in 2019 (Komorowski et al., 2021a).

Building on the increasing recognition of the importance of the creative industries in Wales as well as the policy support developed over time, the Clwstwr programme[12] was launched in 2018. Led by Cardiff University and in partnership with University of South Wales and Cardiff Metropolitan University, Clwstwr was a five-year programme which aimed to create sustainable growth in the creative industries in Wales (Clwstwr, 2019). The programme provided funding support, as well as training and community development, for the local creative industries, with a focus on the screen and news sectors. Clwstwr brought together all major Welsh broadcasters, including BBC Cymru Wales, S4C, and ITV Wales, as well as independent film and television production companies, national companies and creative organisations from Wales, creative coworking spaces, tech start-ups, and local governments such as Cardiff Council and the Welsh government. We outline in the following how the Clwstwr programme has contributed to the emergence and growth of an innovation ecosystem in Wales, as well as the longer-term structures and partnerships that have been put in place to sustain ecosystem support beyond the funded programme's duration.

Clwstwr's *funding calls and R&D support* have been critical for its approach to fostering an innovation ecosystem in the Welsh creative industries. Clwstwr developed and implemented nine funding rounds between 2019 and 2022, funding a total of 118 projects contributing over £3 million in direct funding to the local creative industries. These comprised co-created Seed Funding awards of up to £10K, Open Funding awards of up to £50K, and Challenge Funding awards of up to £50K. The funding rounds were created to help R&D initiatives ranging from experimental development and feasibility studies to industrial research. Through these funding calls, collaborations and valuable innovation connections have been established (see Example 2.1.)

Example 2.1: AMPLYFI: AI In the Newsroom

AMPLYFI[13] received funding from Clwstwr in its Open Funding Round to enhance its existing AI functionality by developing deep-web capability that can provide journalists with greater clarity, deeper source information, and higher accuracy of data than traditional research methods. The project worked with journalists to deliver a fast, accurate, auditable information interface. The aim was to create a highly bespoke product designed specifically with journalists in mind, enabling them to channel their skills and time more effectively building on data available in the web. This project exemplifies the importance of integrating the end-users and professionals into the development of innovative solutions.

Within the 118 projects, more than 700 team members and freelancers were engaged with the 85 financed businesses, and more than 190 organisations were working on R&D projects (including 273 individual freelancers recruited to do R&D). Approximately two-thirds of the 118 funded projects were collaborative initiatives in which the lead firms worked with at least one additional business or freelancer. Clwstwr initiatives were often a combination of three enterprises.

Next to its funding rounds, Clwstwr launched three *Challenge Partnerships*, which were jointly funded and developed calls in conjunction with Challenge Partners, giving SMEs the possibility to collaborate on thematic R&D projects. Clwstwr prioritised socio-cultural impacts next to economic growth and collaborations through these partnership calls. The Green Cymru Challenge Fund,[14] a collaboration between Clwstwr and Ffilm Cymru,[15] made funding available for individuals, organisations, and collaborations across sectors (including media, academia, technology, transportation, energy, water, and waste management) to research and develop new, more sustainable ways of working in film and television (see Example 2.2).

***Example* 2.2: Severn Screen**

Funded through the Clwstwr Green Cymru Challenge Fund, Severn Screen[16] developed a sustainable and collaborative infrastructure model to make film production greener. While productions generate huge amounts of data, Severn Screen aimed to use this data to better understand the carbon footprint and to make better decisions on future productions by analysing the data in a deeper

way via a data analysis platform (Power BI). The process combined carbon footprint analysis with reporting on sustainability success stories and concept development for new apps and platforms. The project of Severn Screen highlights how data-driven innovation can break up data silos in the sector's network, providing a methodology which can be adopted to understand the emissions created by film and TV.

The National Museum Wales Challenge Fund[17] was a collaboration between Clwstwr and Amgueddfa Cymru – National Museum Wales – to investigate innovative and creative methods to rethink the museum experience and attract new audiences. The People's Newsroom Initiative Fund,[18] a Clwstwr collaboration with the Bureau of Investigative Journalism,[19] the Ethnic Minorities and Youth Support Team Wales (EYST),[20] and Lankelly Chase,[21] was designed to develop a new pipeline for media production involving hands-on business and start-up support to design innovative new journalism initiatives and invest in communities traditionally marginalised in media output. Clwstwr thus served as a catalyst for R&D.

Clwstwr served as a *networking and skills development platform for firms and freelancers* in the creative industries in Wales (and beyond), resulting in new contacts and partnerships and a new innovative ecosystem. Clwstwr participants developed a strong sense of community as a result of the programme's activities and knowledge-sharing initiatives, particularly around certain areas or topics. Clwstwr's communications initiatives boosted awareness about the importance of the creative industries in Wales. Between 2019 and 2022, Clwstwr organised 52 events focused on skill development, networking, information transfer, and the promotion of R&D projects. More than 1,300 people attended these events, which were aimed at a variety of audiences and stakeholders and included both public-facing events and cohort-only sessions. Every Clwstwr initiative that received funding was supported by a designated academic and R&D producer, resulting in academic and industrial connections (see Example 2.3).

***Example 2.3*: Modular journalism**

Shirish Kulkarni, journalist, researcher, and community organiser behind Monnow Media,[22] leveraged Clwstwr's assistance to create new methods of journalism storytelling, with a focus on new formats and audience involvement. He created and tested a variety of prototypes for news formats after working with storytellers from various backgrounds and consulting with university experts.

This resulted in a collaborative research study with Cardiff University, which was published in *Journalism Practice* and is already among the top ten most-viewed items on the website (see Kulkarni et al., 2022). His new types of news narrative have had a global impact in newsrooms around the world, including the *Financial Times* and the *Times of India*. This example shows the impact of academia and industry collaboration and networks.

In addition to the previous activities, there were various other areas and initiatives in which Clwstwr aimed at creating networks and collaborations through small grants and support mechanisms. One of the programme's important takeaways from creating such activities is that investment must be accompanied by an innovation ecosystem that provides support and knowledge. This can be time and resource intensive. Clwstwr's outreach consisted of 1,233 meetings with creative businesses at various stages of the process, integrating academic experts and organising 155 workshops and several Ideas Labs run by the partner PDR.[23] The majority of projects (77%) said that Clwstwr improved their perspective on R&D. This aided in the establishment of an innovation culture. As a result, between the beginning and end of Clwstwr, average annual R&D spending for Clwstwr-funded enterprises more than doubled (up 107% to £91,577). Especially targeted R&D funding encourages small companies (a significant majority of the creative industries) to contribute significant resources to R&D. Clwstwr's £3.42 million direct investment in funded projects resulted in an immediate £2.47 million company investment through match-funding, with later further investment totalling more than £5 million – a figure that will increase as more projects reach maturity. This could only be accomplished through collaboration. Overall, programs like Clwstwr can have a significant impact on economic growth, which is also driven by the ecosystems that are built. At a period when COVID-19 meant a drop in average creative company turnover (–3.2%) and employment (–11.3%) in Welsh' creative industries, Clwstwr-funded businesses increased turnover by 14.6% and employment by 21.3%. Clwstwr investment has already resulted in an increase in turnover of £20,446,443 and the creation of 446 additional jobs in the industry. Overall, every £1 of direct funding to businesses has already created £5.98 in turnover and £4.55 in GVA, with more to follow as businesses commercialise (Clwstwr Final Report: Clwstwr, 2023).

Discussion

In this section we analyse the impact small industry–focused R&D grants can have in 1) creating ecosystems of partner networks to support growth in the creative industries; 2) how data-driven innovation expands our

understanding beyond traditional measures of growth or scalability; and 3) realising a more robust notion of value, which is not only economic but also social and cultural (see also Chapter 5).

Our examples highlight that small industry–focused research and support can enable creative industries composed of micro businesses to become drivers of economic growth but that this relies on a diverse ecosystem of networks and partnerships. This chapter has demonstrated that previously independent sectors of the creative industries were funded and connected into a larger network of partnerships to explore R&D projects. We noted that the availability of funding was a critical part in the support of innovation. However, we argue that the partnership working between the educational organisations and industry partners was instrumental in supporting and enabling the ecosystem to grow. These networks were set up with the hope that they could be sustained beyond the duration of the funded projects through these existing partnerships, but future research is needed to analyse if this is the case. In addition, the network was supported by a programme of outreach events, delivered in partnerships with a myriad of hosts and sector stakeholders to expand understanding of data-driven innovation. Finally, the creative ecosystems (the universities and the industry networks) were critical in not only providing the funding and access to creative networks but also the human resources and infrastructure to manage the R&D administration, logistics, mentoring, and support for the freelancers and micro businesses and access other, larger networks for further funding and support in their innovation journey. Thus, these previously independent sectors connected to expand collaborations, improved skills, and expanded knowledge that grew the economy. This, as we noted, took significant human and financial resources.

We argue that the networked model of the creative industries supports different forms of growth, where growth is aligned to efficiencies in operational functionality as opposed to the linear growth model of a market driven economy, perpetuated by the start-up culture (Casnici, 2020). Scalability in the context of the creative industries relates more to efficiencies of these creative businesses by developing their existing product offer which supports the (financial) sustainability of their business proposition. With an industry dominated by micro businesses and sole traders, and with uncertain markets leading to precarity in the sector (hand to mouth), moving from bespoke services and design to scalability in terms of efficiency should thus not be confused with scaling growth as is traditionally perceived in the start-up sector.

Despite the creative industries making a significant contribution to the economy, these creative businesses consisting of 94% micro businesses, are often referred to as 'lifestyle businesses', a derogatory term (Taylor, 2011) that devalues their contribution. Recent research (Ratten, 2022) noted that societal changes in lifestyle trends affects entrepreneurship. Paying attention to cultural changes may thus signal broader changes in entrepreneurship. It is clear from Creative Informatics' research (Elsden et al., 2021) that the value

created through data-driven innovation in the creative industries was not just economic but also social and cultural. Supporting the creative ecology of partnership networks and collaborations – as outlined in our case studies – is evidence that a more flexible model of innovation that enables sustainable growth is facilitated by the network of governance that we outlined at the start of this chapter. The nature of the creative industries, with a significant percentage of SMEs and freelancers, supports a resilience at work: the loss of part of the ecosystem does not affect the overall ecosystem significantly. This would not be the case if the sector were dominated by a few large companies. Based on our collective knowledge of the creative industries, we noted that the fragmentation of the creative sector across a multitude of micro businesses is an asset with a flexibility that can respond quickly to changes in markets. However, the importance of the network is critical in sustaining and connecting those disparate parts. Further analysis of the Creative Clusters programme is expected to be published by the AHRC, but our recommendation is that funding for innovation should support not only the development of new products and services but, critically, should invest in a robust infrastructure that enables a rich ecosystem to develop by resourcing infrastructures (Examples 1 and 2) and enablers (e.g., Example 1.3). Our recommendation, following the network model of governance and the evidence of our case studies, is that investment in supporting the growth and sustenance of network is critical to a viable innovation ecosystem.

Conclusion

This chapter has demonstrated that proximity and access to creative ecologies are key to supporting innovation and growth in not only the creative industries but also to achieving the UK's goals of post-COVID recovery and the 'levelling up' agenda (UK Government, 2022) which aims to balance economic growth across regions.

This chapter shows that investment in networks is fundamental to success in innovation in the creative industries. Second, it also aligns with R&D, given that modest sums in supporting, and particularly the scaffolding infrastructure that supports R&D such as human and financial resources, can have larger effects. The networks also proved significant in attracting additional R&D funding through the networks enabled by the ecosystems. Third, we argue that the networking effect leads to the acquiring of skills through exchanges within the network and that opportunities for training arise from within these networks. (See also Chapter 4.)

However, further research is needed to ascertain how networks, established through the Creative Clusters, for example, can or will survive once the structural support has been withdrawn (funding and human resources) and the networks will rely on established connections within the ecosystem or on other partners to take over those functions.

We argue that national policy needs to support the resourcing of networks by working closely with devolved and regional partners. We argue that sustained investments in the development of networks that support cross-disciplinary creative ecologies are critical to innovation in the creative industries at large but more specifically for data-driven innovation, as it relies so fundamentally on the network governance of the creative industries.

Notes

1 The Creative Industries Policy and Evidence Centre (PEC)'s mapping of the UK's creative clusters is available at: https://www.arcgis.com/apps/View/index.html?appid=007e1de4a01a46b196ad2ccaed20eb3b&extent=-20.3307,49.5899,17.1766,59.5069
2 The South of Scotland Enterprise development agency's map of creative micro businesses in the region is available at: https://www.southofscotlandenterprise.com/media/1848/creative-industries-in-the-south-of-scotland-report.pdf
3 Recordings of the Annual Innovation Showcases can be found here: Creative Informatics Vimeo Account. https://vimeo.com/search?q=creative%20informatics%20innovation%20showcase
4 https://scottie.io/#Our-Work
5 https://creative-edinburgh.com/
6 https://creativeinformatics.org/resident-entrepreneurs/
7 https://creativeinformatics.org/challenge-projects/
8 The Lab event is available to view at https://vimeo.com/497714724
9 https://ukie.org.uk/members/scottish-games-network
10 https://tinderboxcollective.org/playaway/
11 See the Creative Informatics Annual Report, 2022, for more information about the broader networks and ecosystems supported by the project (Annual Report, 2022: https://creativeinformatics.org/wp-content/uploads/2022/06/CI-ANNUAL-REPORT-2022-FINAL-VERSION.pdf)
12 https://clwstwr.org.uk/
13 https://clwstwr.org.uk/projects/ai-newsroom
14 https://clwstwr.org.uk/clwstwr-and-ffilm-cymru-launch-new-green-cymru-challenge-fund-sustainable-screen-sector-wales
15 https://ffilmcymruwales.com
16 https://clwstwr.org.uk/severn-screen-making-film-production-greener
17 https://clwstwr.org.uk/amgueddfa-cymru-challenge
18 https://www.thebureauinvestigates.com/explainers/what-is-the-peoples-newsroom
19 https://www.thebureauinvestigates.com
20 https://eyst.org.uk/
21 https://lankellychase.org.uk/
22 https://clwstwr.org.uk/projects/news-storytelling-through-modular-journalism
23 https://www.cardiffmet.ac.uk/pdr/Pages/default.aspx

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CASE STUDY

Collaborative R&D into new modalities of experience: Civic Digits Theatre Company and *The Big Data Show*

Civic Digits Theatre Company[1] was formed in 2017 by artistic director Clare Duffy, a playwright and director who wanted to create a space to figure out what it means to be human in our digital futures. *The Big Data Show* (https://civicdigits.com/project/the-big-data-show), Civic Digits' first major production, emerged from a chance meeting between Clare and Rupert Goodwins,[2] a technology writer and journalist and chief technology officer for Civic Digits. In 1984 Rupert was one of a group of young hackers involved in gaining access to Prince Philip's BT email, which became the subject of a landmark legal case – an experience which became the inspiration for the show, co-authored by Clare and Rupert.

Following several years of development, *The Big Data Show* has emerged as an immersive hybrid performance exploring cyber resilience and digital citizenship and designed for audiences around 11–13 years old. It takes place simultaneously on mobile phones and either online (delivery via a website) or (as originally envisioned pre-COVID-19) in a theatre/school environment. The show and accompanying workshops are recognised as an SQA-accredited course (Civic Digits, 2021). It has been funded by Creative Scotland, the Scottish government (Cyber Resilience unit), Garfield Weston, and Digital Xtra and co-produced with Perth Theatre and Unlimited Theatre.

Civic Digits first approached CI/Design Informatics in late 2019 to explore potential collaboration for a series of workshops to accompany a planned tour of *The Big Data Show*, which would take the production to schools across Scotland and public performances at the Lyceum Theatre, Edinburgh. Civic Digits worked with Creative Informatics PDRAs Pip Thornton and Susan Lechelt as well as CI/Design Informatics research software engineer Evan Morgan to develop the workshop concept as well as providing some support for evaluation approaches. The workshops were trialled in late 2019 using a 'Build your own motorised emoji' idea that takes facial recognition data and open source data sets and translates it to 'data physicalisation' – a series of motorised blocks/modules that express data in playful and engaging ways (e.g., representing data as the wiggle of a very tangible furry eyebrow). This work builds upon recent Design Informatics research and the emergent 'VizBlocks' software approach, which is a tangible, modular, and hackable toolkit to support physical data visualisation (Visblocks, n.d.).[3] The development of the workshops was mutually beneficial for both Civic Digits and Creative Informatics, as it allowed the existing research approaches to be applied and tested by a highly engaged

and critical young audience. This led to development of the workshop formats themselves, as well as furthering development of the VizBlocks system with benefits for other projects using it. In addition to researcher contributions, Creative Informatics supported the costs of expanding the physical hardware so that sufficient kits could be created for touring.

Civic Digits were able to pivot *The Big Data Show* to a new digital version (*Cy and Bug's Big Data Show*) with performances running from September 2020, developing substantial new expertise to deliver compelling online experiences. An online handbook[4] helped teachers, educators, or guardians to tell the story of the first public hack and how this impacts us today. CI is currently collaborating on potential approaches to package (e.g., as shippable kits) the VizBlocks workshop to schools engaging in a re-imagined workshop format to accompany the online show. This work was dependent on anticipated returns to physical schooling following the easing of lockdowns.

In December 2020 Civic Digits was also successful in securing funding of £50k from Creative Scotland, supported by a further commitment of £9,500 cash and in-kind support from Creative Informatics for 'Digitally Extended and Expanded Performance' workshops build on concepts and literacies introduced in *The Big Data Show*, which encourage children to play, explore, and understand how they can take control and reflect upon their relationship with data. An extensive schedule of workshops and performances had been planned for spring/summer 2020 when the COVID-19 lockdown began. This new R&D project allowed Civic Digits to build on strategic and operational work initiated during development, production, and digital pivot (due to COVID-19) of *The Big Data Show*.

In addition to this new project, Clare Duffy was also successful in an application to become a Creative Informatics Connected Innovator, supporting skills development and explorations of new data-driven and technical approaches that should further enhance Clare and Civic Digits' capability to deliver exceptional and highly innovative new theatrical experiences.

Civic Digits' work also featured at the PlayAway Games Festival organised by Tinderbox Collective and hosted by another CI recipient and Connected Innovator, Brian Baglow (Tinderbox, 2023), and CI Lab #15: *Just the Ticket – Performance, Payment and Data*. Two free performances of *The Big Data Show* took place during Cyber Security Week Scotland in 2021.

As outlined, through the Creative Informatics network, Civic Digits gained access to collaborators, funders, and partners that helped them develop their work and amplify it through the various networks that Creative Informatics connected them to. Thus, the network governance was enabled by the Creative Informatics network to connect to a wide ecosystem of partners.

Inge Panneels

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Case study notes

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3

R&D IN THE CREATIVE INDUSTRIES

Bringing the 'dark matter' of the sector to light with data

Caitlin McDonald, Jennie Jordan, and Graham Hitchen

Abstract

The absence of a theoretically consistent framework for deciding what is or is not a creative industry makes for inconsistent data collection regarding their activities, which has implications for methods, analysis, and sector-related policy recommendations. To achieve insight into how best to support and to grow the creative industries, accurate data needs to be collected, analysed, and shared differently. Though prior research programmes have attempted to address improvements to data-informed policy design in the creative industries, innovation has been relatively slow to be adopted, and data regarding the creative industries is often thought of as 'dark matter'. Based on research examining new methods for the ethical collection, storage, processing, and analysing of data in the creative industries that can support continuous learning, this chapter recommends two improvements: first, the growing body of research on novel frameworks for improving creative industries data should inform future directions for data platforms used by funding agencies and other strategic bodies. Second, interdisciplinary groups of stakeholders should collaborate on improving the creative industries data ecosystem for all.

Introduction

"There is this, what I've sometimes referred to as, the kind of 'dark matter' of the [creative industries] sector, all this stuff that's going on, this activity, but we don't see it, we don't understand it" (research participant 17, leader in a public sector development agency for the creative industries in Scotland).

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The creative industries are often heralded as being entrepreneurial and innovative drivers of urban, regional, and national economies. Yet there are gaps in the data that is used to create policies to support them via local and central government initiatives and inconsistencies regarding how this data is collected, used, reported, and operationalised. Creating a better data-rich environment for policymakers and other stakeholders working with creative industries data would lead to improved outcomes for the sector.

This chapter discusses the current structural and ontological challenges of using data to support policy decisions in the creative industries, the data-driven methods research participants are using to understand and make decisions about the sector, and emergent technological innovations which may address some of the existing challenges of finding and comparing creative industries data. These challenges include a lack of consistency around defining the creative industries, inconsistent data collection leading to both sparse and duplicate data, onerous data collection burdens on businesses and individuals within the sector, a lack of interoperability between existing data sets, and an over-reliance on systematised econometric data at the expense of tacit procedural knowledge which is essential to innovation.

Drawing on our interviews and dialogue-building exercises with research participants, the chapter concludes with our recommendations for improving data systems, including the need to integrate both science, technology, and innovation (STI) and doing, using, and interacting (DUI) data approaches for holistic data-driven decision support for the creative industries. First, we recommend the establishment of a programme to test emergent frameworks for unified, interoperable data standards and mixed-methods approaches to evaluation. Second, interdisciplinary groups of stakeholders working in different roles in the creative industries data ecosystem should collaborate to improve the ecosystem through continuous learning, adapting, and innovating as sectoral changes arise.

Current data paradigms for the creative industries

The UN's Conference on Trade and Development (UNCTAD) argued "Creative industries create employment and income, promote innovation and contribute to societies' well-being" (2022, p. iii). At the same time, it found data gaps and inconsistencies in how data is collected and classified which have implications for policy design. Although hugely successful at establishing a *de facto* world standard for the creative industries and spurring greater understanding of the creative economy within the UK and beyond (Bakhshi et al., 2013, p. 3), the creative industry categorisation is

> inconsistent. Although it does reflect an underlying economic reality, it does not fully capture that reality; it excludes industries with the same

> features as the great majority of those it includes, and includes others which do not share these general features, without a clear rationale for doing so.
>
> *(ibid. p. 6)*

These gaps and inconsistencies were succinctly dubbed 'dark matter' in a research interview with a leader in a public sector development agency for the creative industries in Scotland, quoted previously. In this chapter, we focus on data that is collected for decision-making related to creative industries policy and funding, which includes quantitative elements (like summary industry statistics) and qualitative elements (like case studies.) This data can be a powerful resource to support better decisions, but inconsistent, missing, or wrongly focused data can be detrimental, warping the landscape in which decision-makers operate. This chapter reports on a research collaboration between CRAIC (the Creative Innovation and Research Centre at Loughborough University London),[1] Creative Informatics[2] (Edinburgh's AHRC-funded Creative Cluster), and the Data City[3] (spun out from Open Data Institute Leeds to develop the UK Tech Innovation Index,[4] the Data City is a subscription-based online platform for businesses and public sector bodies. It uses machine learning to combine and analyse data from public and proprietary sources on innovation in the UK economy). The study asked: what are the data (adoption) barriers to innovation in the creative industries? And how can we make data collection, processing, and analysis more useful for data users, including policy makers, funders and data providers, creative businesses, and individuals?

Our research quickly identified divisions in how stakeholders creating and utilising information regarding the creative industries defined and conceptualised data. These fell into a pattern reflecting Jensen et al.'s classification of knowledge and knowledge creation methodologies into science, technology, and innovation and doing, using, and interacting (2007). STI modes are explicitly codified in formal data sets which are comparable and readily mobilised as evidence to support R&D policy. Examples include the UK government's groupings of industries (Standard Industrial Classifications, SIC codes) and occupations (Standard Occupation Classifications, SOC codes), discussed in the section "Data Classification for the Creative Industries." In the DUI model, Jensen et al. maintain that tacit, embodied, and procedural knowledge modes are essential to learning and knowledge exchange.

In the context of data to evaluate R&D in the creative industries, widely used STI knowledge management tools include economic data classified using SIC and SOC codes, as discussed subsequently. DUI is less widely accepted as a reliable decision-making aid among policymakers though frequently used to supplement data missing from STI models or to add qualitative depth to numerical reasoning (Jensen et al., 2007, pp. 680–681).

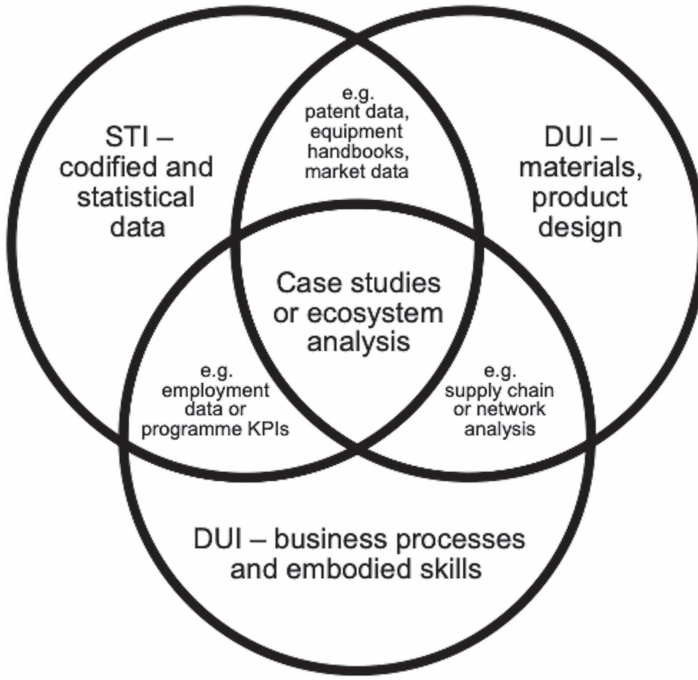

FIGURE 3.1 Interplay between knowledge creation methodologies. © Jennie Jordan, 2023, used with permission.

Method

To understand how policymakers and other stakeholders currently navigate the data challenges enumerated previously, and how the process of data-driven decision-making for the creative industries might be improved, we conducted a three-phase research process. First, in-depth interviews were undertaken with 34 individuals who either provide, collate, or use data within the creative industries in Scotland and beyond. We asked interviewees how they defined data and innovation, how they engaged with and used data, and what problems they associated with the collection and use of data to support strategic decision-making. Research participants included policymakers and policy implementers in public bodies such as government departments, public funding bodies, and enterprise agencies; trade bodies and membership organisations working on behalf of businesses and individuals in the creative industries or subsectors like screen, games, sculpture, etc; individual creatives and creative sector businesses; academic researchers studying innovation in the creative industries; and data platform businesses like customer records management (CRM), ticketing, and audience development software services used by creative businesses and public sector bodies for monitoring, evaluation, and strategic decision-making.

Second, we ran four interactive workshops with creative practitioners, trade bodies, and policy makers, introducing them to the Data City's platform as one example of new, commercially available tools analysing industry data by using machine learning to combine and enrich data sets from multiple sources (Forth, 2021). We then held a roundtable for six data platform companies to identify commonalities and potential collaboration to improve interoperability and standard definitions for data across the creative sector.

Finally, we ran a 'policy hack day', a facilitated workshop with participants from the stakeholder groups listed previously, asking attendees: what actions can be taken to fill data gaps, to make data more transparent, and to drive innovation in creative industry ecosystems? And, of those, what can attendees take forward in their organisations? Attendees used these provocations to collaboratively identify opportunities to improve the creative industries data landscape.

Data classification challenges for the creative industries

The absence of a theoretically consistent framework for deciding what is or is not a creative industry makes for inconsistent data collection methods and analysis, which impacts the ability to make informed and effective local, central, and transnational government policy. Choices about which aspects of industries are included and measured have direct consequences on the public policy interventions adopted (Galloway and Dunlop, 2007). One example of recent difficulties affecting practical policy outcomes caused by this lack of theoretically consistent framework, which particularly concerns detailed and agreed data about working practices among freelancers and micro businesses in the creative industries, were the gaps in the COVID-19 Self-Employment Income Support Scheme identified by Komorowski and Lewis (2020).

Potts and Cunningham propose four conceptual models for the creative industries: welfare, competition, growth, and innovation. The fourth of these, innovation, is particularly relevant to this chapter (2008, p. 233). Rather than treating the creative industries as a public good (as argued by Galloway and Dunlop (2007), a competitive industry the same as any other, or a special driver of growth which percolates out into other sectors, Potts and Cunningham propose that the creative industries act as a higher-order system which coordinates innovation, novelty, and change across multiple sectors:

> this is the same model as proposed for the effect of science, education and technology in the national systems of innovation approach. The creative industries, in this view, originate and coordinate change in the knowledge base of the economy. In consequence they have crucial, not marginal, policy significance.
>
> *(ibid, p. 238)*

Each of these four models has clear implications for setting public policy strategy, with material implications for funding and resourcing different policy choices. The models require vastly different types of data to inform prioritising the creative industries as a radical catalyst for change across the whole economy compared to a funded public good which cannot self-support through competitive means. In this section, we will explore what data sources policymakers currently use for strategic decision-making in relation to innovation in the creative industries, their challenges, and proposed new directions.

SIC and SOC: the best possible compromise?

Probably the most significant creative industry data sources used by policymakers in the UK are the UK government statistics published by the Department for Digital, Culture, Media and Sport (DCMS, 2016). These include occupational data from the Office for National Statistic's (ONS's) annual Labour Force Survey, categorised according to Standard Occupational Classifications (SOC); Gross Value Added (GVA)[5] from the Annual Business Survey segmented by Standard Industrial Classifications (SIC); and data on exports taken from the ONS's trade in goods classification of product by activity statistics (DCMS, 2016, p. 5). SIC codes, used to classify the economic activity of businesses, were first introduced to the UK in 1947 as a means of harmonising data collection and comparison across government departments (Smith and James, 2017, p. 224). SOC codes, used to classify the economic activity of individuals, were first introduced in 1990 (Office for National Statistics, n.d.).

Data sources classified by SIC and SOC remain important for comparing the creative industries with other sectors, especially for bodies needing to consider the opportunity costs of programmes across multiple industries, but our research interviews with creative industries policy bodies found sample sizes are usually too small to analyse subsectors within these data sets. This is compounded by the fact that industry trade and membership bodies are often the first source of data on sectoral concerns as their members ask for help with emerging issues, such as economic precarity during forced cessation of trading during the UK's COVID-19 lockdowns and restrictions in 2020 and 2021.[6] Trade bodies research these issues among their members and produce advocacy documents advising policymakers on proposed courses of action. While this is an important mechanism for influencing policy direction, in research interviews policymakers expressed concerns these reports represent vested interests so lack objectivity. They are keen to ensure "that our understanding of data is not limited by the headlines. I see it as a resource that we have to mine and use very carefully" to shape and monitor "change and progression" (research participant 17, leader in a public sector development agency for the creative industries in Scotland).

The ONS itself recognises the challenges businesses and individuals face in categorising their own economic activities using SOC and SIC codes, as well as the time-consuming nature of manual classification by data specialists (Anthopolous and Wood, 2021). These classification challenges make it harder for policymakers and other strategic decision-makers to get an accurate model of economic activities across many sectors, including the creative industries. This in turn leads to challenges with devising data-informed interventions to support R&D and innovation. While most stakeholders agree SOC and SIC codes have drawbacks, inertia about them has been strong: they are still largely seen as the best possible compromise as a means for cross-industry data comparison and for comparing current to past economic sector change (research participants 3, 4, 9, 17, 20, 34). The next section will discuss attempts to devise new methods for industrial classification.

Innovation spillovers and how to measure them

One classification challenge particular to the creative industries is how to account for creatives working in non-creative industry organisations and businesses as identified by Higgs and Cunningham (2008, pp. 7–30). Their creative trident model distinguished between workers with a cultural profession working in a cultural sector (e.g. an artist in an opera), workers having a cultural profession but working outside the cultural sector (e.g. a designer in car industry), and workers having a non-cultural profession and working in the cultural sector (e.g. a secretary in a film production company) (Higgs and Cunningham, 2008, p. 18). This matters because of the potential for innovation of *spillovers*, "benefits (or costs) of an activity that accrue not to the individual or business undertaking the activity but to other individuals or businesses" (Frontier Economics, 2022a, p. 3). It can be further argued that spillovers are one of the benefits of creative clusters (ibid, p. 6).

Working with industrial data, Bakhshi et al. found "industries with stronger links to the creative industries . . . have stronger innovation performance" (2008, p. 5), arguably a practical recognition of Potts and Cunningham's proposed conceptual model of the creative industries as a higher-order coordination system of innovation (2008). Bakhshi et al. (2013) developed a method for measuring structural changes within the creative economy accounting for spillovers between the creative industries and other economic sectors such as manufacturing, shipping, consumer goods, and so on. Their model measures the proportion of workers in creative occupations (i.e., the first two of Higgs and Cunningham's trident) in any given industry, which Bakhshi et al. referred to as "creative intensity" (p. 3). This can then be indexed to highlight whether creative roles are growing in any economic sector, identifying industries likely to be innovating.

This work laid the groundwork for adopting novel methods for gathering and classifying econometric data about the creative sector (Bakhshi, 2016;

Doeser and Hitchen, 2021; Mateos-Garcia, 2021; Walmsley et al., 2022). The Data City, our partners in this research, previously developed the UK Tech Innovation Index, devised to demonstrate possible replacement mechanisms for SIC and SOC codes (Forth et al., 2018). However, as mentioned, these novel data collection and classification methods are largely unknown to policymakers who continue to rely on SIC and SOC codes for decision-making. Research participant 4, working in a data analysis unit at a UK-wide creative industries public sector body, described the central importance of these classifications:

> So when it comes to data collection and data crunching most [government] agencies do, the National Statistics Office [sic] are collecting that, then we are pulling out the SIC codes or the sub-sectors that are relevant to us, then collating those for the creative industries. We have these . . . economic estimates that are basically GVA [Gross Value Added] trade, etc, for these sort of macro-level statistics. That's our main data collection tool for statistics and the creative industries.

Further, Clive Gillman, director of the Creative Industries at Creative Scotland, a public agency supporting the creative industries, gave a talk describing the importance of ONS data including GVA, SIC, and SOC codes for consistent data upon which to base policy decisions across all government departments at a Life in Data Knowledge Exchange event in 2019 (Gillman, 2019, minute 14:46–33:06).

Like the lack of cohesion around the term 'creative industries', 'innovation' was another contested term in our research interviews. One interviewee said, "innovation isn't a word we use – it's a word that seems like it's from a different discipline," and "If I saw a grant advertised as an 'innovation' grant I would understand it as a science-based thing" (research participant 19, leader at a Scottish screen development agency). Conversely, another participant pointed out the term 'innovation', much like its predecessor term 'digital', gets used as a sort of window-dressing for funding applications, evaluation reports, case studies, and the like (Research participant 34, academic researcher on innovation in the creative industries and director of a government-supported innovation fund for the creative industries). This suggests people working in the creative industries are not aligning their work with economic policy outside the sector, nor with the conceptual frameworks policymakers use to make strategic directions for the sector. Another participant said, "I spend about half my life explaining to people what innovation is!" (Research participant 15, innovation lead at a data platform provider and research consultancy focusing on the creative industries). The lack of a shared understanding of the term, or common frameworks for strategic decision-making, diffuses sector activity which could be more productive and profitable.

Data for decision-making

"[Data is] key points that help people to understand, create new knowledge or inform them if they are making decisions . . . data without a purpose is nothing that really matters, in my opinion" (Research participant 10, academic researcher on innovation in the creative industries).

Policymakers face several challenges attempting to use both STI and DUI data as a decision support tool. From both the prior literature and our research interviews, there is a need for data to support innovation in the creative industries going beyond head counts of creative businesses or workforce totals. Policymakers and strategic decision-makers need to find new mechanisms for understanding how people work across the creative industries and between creative and other economic sectors.

Pockets of knowledge

"Innovation flows through [the] creative industries, for example, [through] the role of freelancers, as pockets of knowledge that get moved through supply chains or across networks" Research participant 9 (policy adviser for a UK-wide joint government-industry forum on the creative industries).

Tacit knowledge discussed by research interviewees included learning about the properties of unfamiliar materials and the potential of new equipment, discussed further in the "Analogue Data" section. In interviews, creative industries practitioners highlighted that their own knowledge and skills development was facilitated by finding experts to partner with or learn from (research participants 2, 5, 27). While some of these experts were sourced through an internet search, others were found through networks and core infrastructural organisations such as studio and workshop facilities and links to universities. Knowledge transfer activity like this is an example of spillovers within the creative industries.

Research participant 9 referred to these spillovers as "pockets of knowledge," per the quote at the start of this section, further stating that describing these pockets has "not necessarily reached . . . mainstream policy articulation and it certainly isn't falling back into creative businesses, who need to articulate and to understand what innovation looks like or is." The importance of places for pockets of knowledge or spillover exchange is corroborated by recent research from Creative Edinburgh and Creative Informatics in their 2022 report on the creative freelancer experience (Connell et al., 2022). This research shows creatives in Edinburgh and the surrounding region particularly value membership organisations such as CodeBase[7] and the Melting Pot[8] as hubs for creating informal and formal knowledge networks among peers. Mechanisms for informal knowledge exchange arising from these membership organisations include co-working spaces and networking events, and formal methods include courses and mentorship schemes. As a project and micro business–based ecosystem which employs a high concentration of

freelancers,[9] this movement between organisations, with its potential to catalyse innovative spillovers, is a critical aspect of the creative economy.

Dark matter

Despite the varied sources policymakers use for evidence-gathering, it became evident through interviews existing sources of trusted data are not sufficient for policymakers, leading to the perception of creative industries' 'dark matter' (participant 17, quoted previously). Our research identified several data platforms currently in use for strategic decision-making at the policy and individual company/organisation level within the creative industries. These platforms can be seen as a response to the gaps in the data about creative industries' economic and innovation activity available through sources like Companies House and the Office for National Statistics' Annual Business Survey. Existing widely known commercial software examples include the Audience Agency,[10] Spektrix,[11] and Data Thistle.[12] Another example is an internal platform developed for the South of Scotland Enterprise Agency (SoSE), a public body focused on supporting economic development within their region. This platform combines standardised data available to anyone from sources such as Companies House with custom-collected information on freelancers working in the region, gathered from surveys and customer relationship management systems maintained by the agency (South of Scotland Enterprise, 2022). While the data, dashboards, and maps in SoSE's platform are not at time of writing available to the public due to data privacy considerations, SoSE hopes to make its work available for companies and individuals to use for a better understanding of opportunities for collaboration and commercial opportunities in the market (Research participant 8).

We interviewed representatives from companies of six data platforms which had been developed for marketing, business, or programme monitoring purposes holding aggregate data on the creative and cultural sectors at national and international levels. These platforms were at various stages of engaging with policymakers to provide decision support. Recent examples included their ability to show, in close to real time, the effects of COVID-19 on the number of events being programmed across the UK, and on audience numbers for these events, for example, Spektrix's ticket sales dashboard released in November 2022 showing comparators to 2019 ticketing levels (Spektrix, 2022).

In interviews, these platforms argued for the benefits of common data standards and open data in enabling innovative applications for policymakers and others wanting data as a decision support tool. This included planning transport provision around major events like Edinburgh's seven August festivals (Data Thistle, 2020) or apps to make collating of climate or equalities data easier, more accurate and timelier. Existing common data standards such as company numbers were being analysed against a range

of econometric measures. Research participants were using them to identify geographical creative industry clusters, sectoral size, and growth, and they believed there was more which could be done if other common standards could be agreed upon, both between themselves and with government.

Other research participants, however, expressed more scepticism about statistical data, describing it as lacking nuance. It was "zeros and ones in different boxes that make our work abstract in some way. It's an intended simplification that ends up being a reduction" (Research participant 19). Such data did not contain the DUI know-how and know-who elements of creative work intrinsic to innovation and innovation ecosystems, as discussed in the following.

Analogue data

> [To find out] who's doing what when, you can anecdotally talk it through with your peers, and a lot can be done through lots of different groups; a lot of information is shared informally. When it gets to the outcome stage lots of organisations have newsletters, or there's something happening that you get invited to . . . and that's also a way in to find out opportunities you didn't know about. . . . So that makes it quite organic, doesn't it?
>
> *(Research participant 5, independent artist working as a sole trader)*

Several different participants referred to DUI knowledge in related ways which we began to think of as 'analogue data' as one of its main defining features was its lack of quantifiability. This kind of knowing was highly significant to the independent creatives in the research yet is largely overlooked in both the innovation literature and policymaking. Unlike scientific experimentation to which it is allied, it is not always possible to generalise or replicate skills or embodied knowledge. As Jensen et al. argue, DUI-mode knowledge is acquired through practice and situated in specific context where cumulative know-how and know-who enables successful transfer of idea to product via an infrastructure of resourced and resourceful entrepreneurs, a suitably educated workforce and a stable and supportive regulatory environment (2007, p. 682).

Research on creative cluster case studies combining STI and DUI data has highlighted the highly situated nature of the creative industries within place-based networks and supply chains (e.g., Seipel et al., 2020; Doeser and Hitchen, 2021; Frontier Economics, 2022b; Pricewaterhouse Coopers LLP, 2022). Co-location of different elements of the supply chain from design to manufacture to marketing facilitate product and process innovation in response to changing market conditions (Mateos-Garcia and Bakhshi, 2016). Know-how and know-who are important in explaining the power of creative

clusters to support innovation and growth (ibid). While there are no easy solutions to collating DUI data, this study supports UNCTAD's argument: a "Lack of harmonized definitions and methodologies and lack of data are among the key challenges to measuring the creative economy. Lack of data may lead to some creative industries and activities being overlooked by analysis, policy design and development" (UNCTAD, 2022, p. 10).

(Precarious) piles of knowledge

> The rest of it is kind of ad hoc and I don't think we have a central place of gathering all of that data. Really, it tends to, for my team at least, come in quite ad hoc and gets added to our little pile of information, so we can refer to it when we're making decisions or advising a minister on a decision.
>
> *(Research participant 20, leader in creative industries policy in the Scottish government's Culture Directorate)*

Another concern about the sources of data policymakers rely upon which is particularly relevant to R&D programmes: these are often based on evaluations of programmes. These sources are reporting on events, outputs and impacts sometime after the fact. This delay, when combined with the timescales needed to agree new programmes, is seen as problematic in fast-changing environments like digitally focused creative industries subsectors, including software engineering and gaming (see, for example, the Scottish Games Network case study accompanying this chapter). The ability to develop new industrial classifications at speed, reflecting the rapidly shifting nature of industrial change, is one of the challenges novel frameworks and methods this work attempts to address.

In a scoping study for DCMS, consultancies MyCake and the Audience Agency (2021) reviewed a range of economic data available on cultural sector activity, concluding the ad hoc nature of data collection for policy decisions has led to gaps in understanding how the cultural economy operates, per the interviewee quote at the start of this section. Material impacts of these gaps included undermining the government's support for the sector during the COVID-19 pandemic. MyCake and the Audience Agency identified data sources which were not being well used, such as administrative data in annual reports and grant returns, and recommended finding ways to exploit these. To that end, data collection would have to be standardised and made available in machine-readable formats to allow for different datasets to be linked and analysed systematically. They propose using data already collected by Companies House, the Charity Commission, and Interdepartmental Business Register combined into a new cultural sector data platform "built and maintained by stakeholders from across the sector" (ibid, p. 40). This would

be supplemented by existing operational data (e.g., annual reports; statutory financial information) from companies and charitable bodies working in the sector, adding further data sources like funding, membership bodies, and so on in a phased approach as these currently fragmented sources become standardised and combinable.

While the motivation is to make data more available, robust, and dynamic, these recommendations are not unproblematic. First, almost a third of workers in the creative industries are self-employed (Easton and Beckett, 2021). This makes Companies House data on number and location of companies and data on staff costs unreliable. Panneels describes this problem as it relates to the economic crisis for creatives across the UK in the wake of COVID-19, highlighting these data points are not consistent across the whole of the creative industries (2020). Some subsectors such as craft exceed 80% working as sole traders. Data on this missing economic activity is currently collected using methods like surveys which are costly, time consuming, and collected at irregular intervals (ibid). In relation to innovation, it is likely to underestimate the amount invested by companies as R&D is likely to be undertaken at least in part by those freelancers.

There is a further risk of the segmentation becoming fossilised. Technology is rapidly changing patterns of production in many creative sectors, with visual effects (VFX) and virtual production (VP) for example starting to take place during filming rather than post-production. Finally, there is the ethical issue of collecting data for one purpose – grant monitoring or tax collection, for example, and then using it for other types of decision-making. See Chapter 7 for further discussion of the challenges of privacy issues and legal frameworks relevant to data collection for the creative industries.

Mapping the creative industries jigsaw puzzle

> I've taken over the remit to look after the creative industries and in doing that I need to understand, okay: who is working in the creative industries, what is it they're doing, where they're doing it, how are they doing it, who are they doing it with. And what other connections are there, and there's a multitude of areas . . . part of the wedding industry, for instance, quite a number of the creative industries are [included]. There's a whole host of touch points to try and build that picture, so I kind of look at it as a massive jigsaw puzzle of the creative industries.
>
> *(Research participant 8, strategist at a Scottish enterprise agency)*

As we've mentioned, data on micro businesses, especially freelancers, has largely been recognised as a data blind spot for policymakers: the *dark matter* that is there, influencing the sector around it, but only visible through indirect

effects on other standard econometric mechanisms of capturing value. As well as the geographic maps available in the Data City's online platform, in our research we encountered three different interactive geographic mappings attempting to visualise the importance of freelancers within a creative cluster or local economy. There are other localised attempts to solve this problem through a geographic mapping framework; we present these three as indicative of themes we've identified elsewhere in this chapter: different stakeholders have different views of what innovation is and therefore prioritise different typologies or values of innovation. Hence in creating the data structures they use to understand innovation ecosystems, including the freelancers operating within those systems, they prioritise different data inputs. Further, choosing interactive geographic maps as a data output over other possible means for sharing data (e.g., charts, tables, summary statistics) indicates physical geographies remain an important feature for policymakers and funders even in a time of increasing digitisation in the creative industries and beyond.

The first example is Creative Informatics' work plotting individual creatives and businesses by postcode area onto an interactive map of the six local authorities which make up the City Deal region: Edinburgh City; East-, West- and Mid-Lothian; South Fife; and the Scottish Borders (Helgason and Panneels, 2021): the catchment area for Creative Informatics' creative cluster funding. Two versions of the map show the businesses using the Scottish Creative and Cultural Industries Codes (SCCI) classification codes (Creative Informatics Map (SCCI Markers), n.d.) or the DCMS creative industries definition (Creative Informatics Map (DCMS Markers), n.d.) described earlier in this chapter. Relying on a government-published data source (FAME data (Bureau van Dijk Electronic Publishing Ltd, n.d.a)) was insufficient to provide the full picture: researchers' personal knowledge of the local creative economy, and consultation with local creative businesses to correct wrong or add missing data, was required to populate the map.

The second project, Creative Economy Atlas Cymru, was created by the Welsh creative cluster Clwstwr to explore the geographical distribution and scale of the creative industries across Wales broken down by creative sector (Clwstwr, n.d.). This also relies on a government-published data source (Orbis (Bureau van Dijk Electronic Publishing Ltd, n.d.b)), with a similar mechanism of manual updates by researchers based on their personal knowledge of the local cultural economy and consultations with creative businesses within the area to add or update the map.

As described earlier, South of Scotland Enterprise (SoSE) built a data platform explorable through a discovery dashboard and map of its local creative economies. Keeping this data accurate, complete, and up to date requires a comprehensive knowledge of the local business landscape in the south of Scotland, something achieved primarily through personal relationship between SoSE and its constituents.

All three projects hold in common the use of a standard data source supplemented by extensive local knowledge networks to keep their maps current, a comprehensive yet time consuming process. All three projects also show a clear need for feedback mechanisms into these standard data sets allowing local businesses, or perhaps trusted trade bodies or advocacy organisations, to audit and repair missing and incorrect data. Both of these challenges represent problems which the novel data capture, processing and analysis methods discussed in the following attempt to address.

Exploring the 'dark matter' with novel data processing methods

As outlined earlier in "Innovation Spillovers and How to Measure Them," researchers have begun experimenting with automated forms of data capture and assessment for economic activity in the creative industries. The insights from these projects suggest routes for standardised data frameworks of machine-readable creative sector data (MyCake and The Audience Agency, 2021) and for dynamic industrial classifications (Bakhshi, 2021). Adopting these frameworks would radically change future policy, investment strategies, and economic analytical methods for the creative industries.

Increasing machine-readable data flow about the creative industries has potential to improve data-driven decision-making, but like all automation initiatives, it also creates new challenges. Examples of digital data exacerbating existing inequalities and harms in society, either intentionally or unintentionally, are extensively catalogued in both academic literature (e.g. Robinson et al., 2015; Vallor, 2016; Hicks, 2017; Lutz, 2019; Beaunoyer et al., 2020; Helsper, 2021) and in writing for non-academic audiences (e.g. O'Neil, 2017; Bowles, 2018; Chowdhury and Mulani, 2018; Williams, 2018; McDonald, 2019; Bartoletti, 2020).

There are a few examples of where systems have gone right, providing lessons which could be adapted for any new systems designed to serve the creative industries. For example, medical data is of high value for research but also highly sensitive and personal for each patient (NHS Confederation 2024, n.d.). Building on existing patient confidentiality standards in England, the Caldicott Principles (National Data Guardian, 2020), the Wellcome Institute devised a multi-year research programme delving into public attitudes towards the use of patient data in research. These yielded six core recommendations to ensure the effective use of patient data, attempting to avoid repeating prior mistakes which led to widespread public distrust (Ipsos MORI, 2016). These recommendations were fed into the development of the EU's General Data Protection Legislation, showing a consultative process around data ethics and governance practices can lead to real-world policy results and could be tailored to the creative industries' specific needs and concerns. Creative Informatics developed an ethics statement including a self-review checklist specifically designed for the creative industries

(Osborne et al., 2020). Further tools relevant to developing appropriate data ethics frameworks include the Open Data Institute's data ethics canvas (The Open Data Institute, 2021), the UK government's Data Ethics Framework (Central Digital and Data Office, 2020), Doteveryone's consequence scanning method (Doteveryone, n.d.), and the IEEE's work on Ethically Aligned Design (IEEE, n.d.).

The creative industries are part of a broader economic context of vast industrial change: in an increasingly digitised economy, skills required for roles and tasks are changing more rapidly than existing classification methods can capture. The appetite for an industrial classification system which uses the new technologies available to more flexibly keep up with dynamic and evolving roles is growing across the entire economy. In this context, the creative industries could act as a testing ground for experimenting with different models. The DCMS-commissioned scoping study by MyCake and the Audience Agency demonstrated policymakers are moving from recognising data problems to taking action. In other words, the time is ripe for the experiments mentioned previously, until now largely niche and unadopted, to move into the mainstream. One potential way to put these experiments into action is through real-time industrial classification.

The potential of real-time industrial classification

In our research, we chose the Data City as partners because they are implementing novel methods for measuring innovation and industrial impact, moving beyond SIC and SOC codes; demonstrating in a commercial setting possible replacement mechanism for SIC and SOC codes (Forth et al., 2018), the Data City now works across multiple sectors to explore dynamic industrial classification mechanisms. It builds real time industrial classifications (RTICs) using a combination of public and commercially available data sources such as Companies House data, Innovate UK funding data, Red Flag Alert company financial information, and descriptive text scraped from company websites. For this project, the Data City built two new RTICs for comparison: one based on the DCMS definitions of the creative industries using descriptors from the SIC codes specified to be within those nine sectors and a custom *digital creative industries* classification which overlaps with but is distinct from the DCMS definitions. We used these RTICs in our research workshops mentioned earlier in the chapter to elicit the opportunities and challenges policymakers, creative practitioners, and trade bodies identified with data presented in this way.

Research participants were able to identify potential uses for the RTICs in their day-to-day decision-making processes, for example, through comparative market analysis for funding applications or annual impact reports. Participants also described challenges with the data they found through the platform, often related to how the Data City's machine learning classification

tools had categorised particular businesses based on data from Companies House and other automatically collected sources. As a result of this and other research, the Data City is now introducing more tools for registered companies and sole traders to manually correct information within their data set.

As the Data City is a subscription platform, in common with the other commercial market tools described earlier, its benefits are accessible only to those who can afford the price of the insights it provides. Paid-for platforms providing comparative economic insights are commonly used tools in commercial businesses and public sector organisations alike, but some stakeholders in the creative industries may struggle to find the budget for these data platforms, including small or early-stage businesses, third-sector organisations, and freelancers. The DCMS scoping study mentioned earlier outlining the path to a unified UK-wide data platform for all the creative industries described a system "built and maintained by stakeholders from across the sector" (MyCake and The Audience Agency, 2021), but who would constitute such a stakeholder and what material or effort costs would be involved in building, maintaining, and accessing the envisioned system are not defined within the study.

An additional area of high potential for platforms like the Data City is their ability to cluster data, showing interconnectivity between companies, supply chains, and subsectors within the creative industries and other economic sectors. While the Data City's data is still based on registered companies which therefore excludes sole traders, if freelancers are "pockets of knowledge" who stimulate innovation through spillovers, real data allowing the hypothesis to be tested would be a highly valuable starting point. Strategic decision-makers could use this data for identifying areas of future economic opportunity and for research into how to maximise those opportunities.

The bridge between change and art

"Data [i]s the bridge between change and art, and [its purpose is to make] change in the industry" (Research participant 29, executive of a UK membership organisation focused on increasing diversity in the broadcasting sector).

Participant 29 succinctly describes the function of data in a decision-making process, when used effectively: to make change. This interviewee, and others, also focused on the importance of using data to build a base of shared understanding in order to effect change.

In our research, we held two dialogue-building exercises to build that shared understanding and bring about the conditions for change: first, our data platform roundtable, a Chatham House Rule[13] discussion among entities which would normally perceive themselves as in competition. The platforms we brought together were able to identify ways they could collaborate to address some of the core data problems identified earlier in this chapter.

While no data set is perfect, improvements particularly around common data standards, better data capture mechanisms for freelancers, and real-time data for continuous learning will go a long way to recognising the value they add to the sector.

Second, our 'policy hack day' involving a range of stakeholders as enumerated at the start of the Methods section who either use, provide, or store and aggregate data about the creative industries to reflect on our early findings and discuss what they could practically do to support improvements to data-informed decision making for the creative industries. Through bringing together groups with varying perspectives, we were able not only to report back on early findings from this research but also to seed provocations for dialogue and further change: this research can provide recommendations, including self-review questions tailored to specific stakeholder groups to spark change in the creative industries data landscape (McDonald and Jordan, 2023), but it is up to the community of interested stakeholders to enact those changes.

Conclusions: recommendations to improve data for decision-making in the creative industries

Throughout this chapter we have described the potential of innovation ecosystems for driving value not only in the creative sector but across the economy as a whole. The creative industries present a unique econometric data challenge due to the high proportion of freelancers in the sector and the relative paucity of means for freelancers to identify important knowledge exchange, skills, and resource development opportunities, including material support in the form of studios with physical assets and equipment. This chapter focuses on data about creative industries activity in the form of products and services, but it is worth noting there are also a paucity of mechanisms to capture indicators of intellectual property value in the sector (see Chapter 7, "Ownership and Control in Creative Technology," for further consideration of IP and rights issues in the sector).

Crucially, especially in an industry with such a high proportion of freelancers, establishing relationships of trust which allow these network effects to take place is often reliant on the social capital of key individuals or institutions. To fully capture the value in these networks, neither a fully abstract, structured approach nor a fully qualitative, descriptive approach will work: a blend of the STI and DUI modes of knowledge creation is required. The creative clusters programme put in place the mechanisms for those knowledge exchange, skills, and resource development opportunities to exist around the UK, establishing networks providing the resources and support for *pockets of knowledge* to accelerate exchanges of skills, capabilities, and materials across the creative industries and beyond, as an innovation system for the

whole economy, as argued by Potts and Cunningham earlier. Data solutions capturing all of this value will require combining structured data sets with the individual relationships which showcase real on-the-ground evolving knowledge. Ideally this system would take the emergent properties of DUI knowledge and eventually codify them into the structured frameworks of STI knowledge, with the awareness there will always be some latency and loss between the two modes. Making this data transparent to everyone involved in its collection, processing, and analysis – removing the one-way street participants identified as a key challenge – will also enhance its value for creating better decisions, both for policymakers and creative organisations, trade bodies, and individual creative practitioners. Data transparency facilitates mechanisms for challenging established wisdom and creates the conditions to push for change. Further, developing continuous learning mechanisms through better data capture, analysis, and sharing will enable more sophisticated data analysis and improved data-informed decision-making than the current system of infrequent reporting cycles or ad-hoc surveys.

In addition to the DCMS scoping study on developing a unified, interoperable data standard described earlier, the Arts and Humanities Research Council also recognises the need for improvements. As part of the 2023 Convergent Screen Technologies And performance in Realtime (CoSTAR) investment in R&D for the Performance and Screen sectors, CoSTAR is establishing an Insight and Foresight unit which will collect and analyse data relating both to the screen industry and to wider creative technologies (UK Research and Innovation, n.d.). We therefore recommend the Insight and Foresight unit engage with the growing body of research referenced previously on developing novel frameworks for analysing creative industries data which recognises the value of both STI and DUI data, as well as monitoring new technologies and how they may be exploited for improving data collection, processing, analysis, and sharing. The work developed by CoSTAR's Insight and Foresight can act as a model upon which to build a cohesive sector-wide analysis and insight framework for the wide variety of stakeholders who provide, process, store, analyse and share creative industries' data for decision-making. We further recommend funding agencies and other international strategic bodies also work towards supporting the infrastructure necessary to capture and analyse this data, which will lead to better strategic decision-making for the creative industries worldwide.

The act of conducting data collection can itself be a form of relationship establishment, as in South of Scotland Enterprise's continuous networking calls with its constituents to discover data gaps and new knowledge. In fact, our entire project worked as a sort of mini-innovation ecosystem not as a place-based cluster but instead a knowledge- or interest-based one: what research participants told us they most valued about participating in the project, especially the research workshops and policy hack day, was the

opportunity to connect with stakeholders from a variety of backgrounds with very different perspectives on the challenges of data for the creative industries and a range of skills and knowledge to work towards solving the problem. This is doing, using, and interacting innovation in action. Through our research, we were able provide a catalyst for starting conversations on these challenges among various stakeholders who do not normally interact, conversations which will now lead to real-world impacts. In other words, echoing Potts and Cunningham's point about the creative industries as a whole, this project has originated and coordinated change in the knowledge base about this sector – exactly what a creative ecosystem should do.

Notes

1 https://craic.lboro.ac.uk/
2 https://creativeinformatics.org/
3 https://thedatacity.com/
4 https://thedatacity.com/products/uk-tech-innovation-index-2
5 Gross value added (GVA) measures the contribution to the economy of each individual producer, industry or sector. It is the value of the amount of goods and services that have been produced, less the cost of all inputs and raw materials that are directly attributable to that production (https://www.gov.uk/government/statistics/rural-productivity/rural-productivity-and-gross-value-added-gva).
6 The Institute for Government usefully summarises a timeline of these restrictions in their infographic (2022).
7 https://www.thisiscodebase.com/edinburgh
8 https://www.themeltingpotedinburgh.org.uk/
9 Easton and Becket found 76% of creative industries companies worked with a freelancer over the 12 months to March 2020 (2021).
10 https://www.theaudienceagency.org/
11 https://www.spektrix.com/
12 https://api.datathistle.com/
13 The Chatham House Rule, found at https://www.chathamhouse.org/about-us/chatham-house-rule, was provided to participants in advance of the roundtable.

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CASE STUDY

Using data to support Scotland's games sector: Brian Baglow and Scottish Games Network

The Scottish Games Network[1] is an umbrella organisation which brings together relevant resources and information across the interactive entertainment sector in Scotland, and encompasses and supports the cultural, creative, academic, government, and other organisations supporting and involved in the Scottish video games sector.

Scottish Games Network founder Brian Baglow actively engaged with Creative Informatics' opportunities from the start of the programme through his independent connections and work with InGAME,[2] the AHRC-funded Creative Industries Clusters Programme led by Abertay University in partnership with the University of Dundee and the University of St Andrews.

Prior to establishing the network, Baglow applied to the first round of the Creative Informatics Connected Innovators strand and was awarded £10,000 of funding in September 2020 to support data-led research into Scotland's games sector. At the time, as he identified in his proposal, no reliable data available about the nature of the sector, and his Connected Innovators project sought to address this through calls for participation in surveys about the industry, as well as research using existing, but partial, datasets.

Emerging findings from Baglow's research were publicised through industry connections in the Dundee region and across Scotland, with findings showcased in a substantial feature in April 2021 in MCV/DEVELOP (MCV, 2021), a leading outlet for the UK games industry. His research found that in 2020 there were 425 companies working in the Scottish games sector, with 85 new games developers registered in 2020 alone. Edinburgh was found to be the region with the most registered games developers, followed by Glasgow, and then Dundee, which had previously been the leading area of Scotland for the games development sector.

Since Baglow's Connected Innovators project and the founding of the network, he and Scottish Games Network have been consistently raising awareness of the games sector's role in the Scottish creative industries. The data about the Scottish games ecosystem captured during his Connected Innovators project has meant that Scottish Games Network's advocacy for further development of the sector has been data-driven, building their case on both qualitative and quantitative evidence of its impact.

Following completion of the work supported by Creative Informatics, Baglow was awarded a further £20,000 by the Scottish government in April 2021 to develop this work and explore how the network might best support the sector. He was also awarded a further £50,000 from the Scottish Government Ecosystem Fund in connection with the Scottish Technology Ecosystem Review

(STER) in 2021, which supported the first ever Scottish Games Week[3] – a week of networking events to bring the Scottish games sector together across the country – in 2022, which returned again in October–November 2023.

In addition, the data collected by Baglow and the Scottish Games Network fed into research conducted by others. These included a project with InGAME (InGAME, 2021) that mapped the key challenges facing the Scottish games sector and programmed workshops to explore possible solutions and ways to address them. That project was shared with researchers from the Adam Smith Business School at the University of Glasgow, who produced a positioning paper (University of Glasgow et al., 2022) on ways to develop a successful and sustainable games ecosystem in Scotland. Together, these collaborations through the Scottish Games Network have created a blueprint for making the sector more connected, collaborative, and successful, both culturally and commercially.

As well as building connections through the Scottish Games Network, Baglow has actively promoted Creative Informatics opportunities to Scotland's gaming sector since the outset and has directly referred applicants and participants to the programme, supporting links between Scotland's Creative Industries Clusters Programmes.

Vikki Jones

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Case study notes

1 https://scottishgames.net
2 https://innovationforgames.com
3 https://gamesweek.scot

4

DIGITAL AND DATA LITERACY

Models for data training and upskilling for the future creative industries

Nicola Osborne, Ingi Helgason, Susan Lechelt, Lucia Michielin, Inge Panneels, Caroline Parkinson, Michael Smyth, Jen Ross, Yasmin Sulaiman, and Katherine Warren

Abstract

In this chapter we explore models for training and upskilling people in the creative industries in data, technology and entrepreneurial skills, situating this in the wider skills and training context. We will particularly look at the challenges of delivering training in the creative sector where innovation and problem solving are core skills, but capacity for continuous professional development is frequently limited by the nature of employment/freelancer working and existing data and business literacy.

We will consider how contemporary perspectives on learning, for example, those that see learning as emerging from within an assemblage of people, technologies, networks, spaces and other objects and actors (Fenwick, 2011), can help explain the ways that activities and interventions, such as those developed for the Creative Informatics programme, can generate conditions for individuals, teams and local networks to become part of flows and structures of skills development. Concepts of scaffolding (Vygotsky and Cole, 1978) will be brought together with these perspectives to explore the blends of formalised training offers and informal learning and reflection that emerged through the research and development process. In the context of start-up communities, informal and often precarious work, and cluster environments where diverse skill sets are sought and delivered across local networks, the blurring of boundaries and cross walking of language amongst peers is particularly notable. We consider what the Creative Informatics (CI) and the UKRI (UK Research and Innovation) Creative Industries Clusters Programme (CICP) contexts reveal about productive methods and pedagogies

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for the future delivery of skills and training in complex networked contexts, with particular discussion of mechanisms to support those practitioners who work outside of large organisations and therefore rely on self-directed learning. In particular, we show that scaffolding – as part of a research and development (R&D) journey – can be a part of training and support, albeit one that is not often mentioned in prior literature in this space.

Introduction

Practitioners in the creative industries (as in many areas of the economy) operate within the context of an increasingly rapid pace of digital transformation that is changing how they develop, produce, and distribute their work. In the United Kingdom, the term 'CreaTech' (Tech Nation, 2021; Siepel et al., 2022) has come to describe this intersection where creative skills meet emerging technologies. The consequence of this disruptive digital shift is an increasing pressure on those working in the creative industries, whether as employees, freelancers or as micro businesses,[1] to continuously acquire new technical skills and build upon existing proficiencies for creative production, collaboration, innovation and dissemination. This shift has been part of a longstanding process that looks likely to continue and accelerate, with opportunities – as well as gaps in skills and confidence – particularly highlighted by rapid shifts and innovative experiments in digital-first and 'hybrid' work in response to the COVID-19 pandemic.

The impact of new technologies, resultant changes to business and employment models and changing perceptions and value of creative work also intersect with funding challenges specific to the creative sector, including reductions in state funding for arts organisations and works (Shaw, 2023; Behr, 2022; Sharratt, 2023; Morgan, 2023a, 2023b) and challenges in funder and investor understanding and/or incentives to invest in creative businesses (Di Novo, 2022; Andrews, 2022; Callanan, 2021), despite the economic and social impact of creative industries (Creative UK Group, 2021; Aspen Global Innovators Group, 2018). It is in this complex and dynamic context – which presents both rich opportunities and significant threats to creative practitioners – that we explore the role of skills and training models for the current and future creative industries.

Additionally, in the UK, the economic growth of the creative industries relative to other sectors has highlighted the importance of creative skills, talent and agility to the economy (Bazalgette, 2021). The value of creative skills and roles is also recognised as having important 'spillover' benefits to other industries and areas of the economy (Frontier Economics, 2022; Design Council, 2022, see also Chapter 3), and (despite the emergence of generative AI (see Chapter 9) and other forms of autonomous creation of IP), it is predicted that "combinations of creative and digital skills will become more valued by employers in the future" (Bakhshi et al., 2019), suggesting a range

of additional benefits arising from effective training and development of such CreaTech skillsets extending significantly beyond traditional creative sectors. We will explore some of the key skills and literacies required for creatives to engage in this new space, and we will reflect on how the nature of creative businesses and this rapidly changing technology context shapes the types of training and development approaches that have most impact. We identify particular barriers and opportunities specific to the creative industries, and we discuss training models operating at scale through the Creative Informatics programme (introduced in Chapter 1 and considered throughout this book), reflecting on their impact and efficacy.

Skills development and the nature of creative employment

The creative industries workforce is disproportionally comprised of individuals or micro enterprises, including freelancers, self-employed and temporary workers. In the UK approximately 94% of creative industries businesses are classed as micro-businesses (fewer than 10 staff) (Creative Industries Council, 2021), and about a third of the industry is self-employed (including freelancers) (Easton and Beckett, 2021), although we also note that there are ongoing issues around data collection and associated understanding of this workforce (Panneels et al., 2021). Whilst some creative subsectors and specialisms make use of more formal continuing professional development routes, sometimes tied to formal accreditation pathways (e.g., architecture), many creative practitioners lack a structured approach and formal support network to enable development. Awareness, access and upkeep of data skills, such as technical and digital training, can be particularly challenging to access and maintain (Parkinson et al., 2020), and adoption of data skills may benefit from reframing as more accessible 'creative data literacy' approaches (D'Ignazio, 2017) and consideration of data literacy capabilities as a broad skillset shared across a community (Matthews, 2016).

Creative employment can be defined as both 'occupations in the creative industries and creative occupations in other industries' (Comunian et al., 2021), and the technologies that are adopted by creatives are therefore influenced by the standards and norms within their own workplace or sector. This in turn influences the skills that they need proficiency in. For the individual practitioner, there may be extra steps involved in finding out about technologies and skills that are relevant to their practice, including social influence and peer support (Palani et al., 2022). Additionally, training and development opportunities (even when provided free at the point of use) can present significant financial barriers and 'opportunity cost' for freelancers, self-employed and micro-SME (small and medium-sized enterprise) employees, as they represent time that cannot be billed to any client. Individuals are thus either entirely unpaid to upskill, or costs need to be embedded in the creative's business model and pricing of work for other projects or clients. These

challenges can be exacerbated by gaps or exclusions in the funding environment (House of Lords Communications and Digital Committee, 2023) by the short notice nature of freelance creative work (Ozimek, 2021).

Current specialist trends affecting the creative sector include virtual production (VP), extended reality (XR) technologies and the emergence of artificial intelligence (AI) (Davies et al., 2020). Recent rapid developments in AI have seen this technology becoming more directly involved in the development of creative content, although its full impact and potential are as yet uncertain (Anantrasirichai and Bull, 2021); there are emerging skills demands (Lassebie, 2023) and specific creative funding opportunities in the AI space (Browning, 2023). Creative practitioners can be proactive and motivated by their own curiosity and passion to stay informed, or there can be specific learning needs and purposes identified that they need to attend to (van Laar et al., 2022, p. 202). However, for the creative practitioner, the acquisition of specialist technology skills is only part of the story, and even that can be a complex undertaking (Helgason et al., 2023). Knowing which technologies to invest time and resources into learning, and to what level of proficiency, along with keeping up to date with broader technological developments that may impact the practitioner's business, are all substantial challenges, especially for those creatives who lack the infrastructure of being part of a supportive organisation or large enterprise.

Chapter 2 in this book specifically discusses the importance of supportive ecosystems and networks to support and enable data-driven innovation, and furthermore, networks have been proven to support economic sustainability in the creative industries (Bakhshi et al., 2013; Komorowski et al., 2021). In addition, with a focus on shared creation and collaborative activity, 'communities of practice' as described by Goodwin (2019) and (in the context of start-ups) by Cartland and Maras (2023) can be viewed as a form of social learning environment relevant to the creative industries that promote the development of self-efficacy for their participants and members.

The role of ecosystems and networks, and formal training opportunities, are highly connected to other factors in developing creative careers and practices. As in other informal learning contexts, creative skills are often nurtured through the building of creatives' own socio-material 'assemblages' of resources – the information, resources including places and tangible things, the people and the communities that all combine and interact to produce skills, expertise and professional identity/ies (Fenwick, 2011). Whilst these (usually) self-led tactics are well established by creatives in developing their skills and knowledge in their own domain, to gain understanding, skills and potentially mastery of digital and CreaTech skills, there is a need for them to venture into (often) unfamiliar technical domains with their own cultures, languages and ways of discovering and problem solving. Creatives must find a way to navigate 'polycontextuality' and boundary crossing (Engeström,

1995), working across complex and parallel areas with limited shared vocabularies and processes.

Understanding confidence and literacies gaps across disciplines

Skills, training and knowledge acquisition are crucial for creatives seeking to work with data, data-driven approaches and new technologies. However, for many creatives seeking to expand, pivot or develop their practice, one of the biggest challenges across creative and technical worlds is having the confidence to cross the boundaries of their home discipline or practice in the first place. Our own observation, drawn from the Creative Informatics programme, is that this issue of confidence is not limited to creative practitioners but is shared by others, including technical specialists who may feel as uncomfortable with the language, culture and processes of creative practices as their counterparts feel about the data and technology sphere. The variances and occasional friction of these differences of approach and experience are a key feature and can be, in ideal circumstances, a benefit of polycontextuality.

As an example of the benefits of a polycontextual creative practice, Creative Informatics[2] alumni Jeni Allison,[3] a knitwear designer, has also developed an innovative business in which customers self-design bespoke knitted products through a web application, which are then produced as one-offs but as part of a scalable, reproducible and environmentally efficient process. The concept has required working across the parallel fields of traditional Scottish textile production and industrial manufacturing, high-end knitwear design and software engineering. Each of these fields has distinct practices, values, languages and cultures, but Jeni's business model produces (positive) disruption and a new business model by viewing key luxury knitwear challenges through a polycontextual lens and reimagining the processes and relationships across design, manufacturing, environmental values and the customer experience.

What kinds of skills are needed?

An often-quoted theory of what it takes to build a start-up originates in a SXSW[4] session from 2012, where Rei Inamoto, who at that time was chief creative officer for ideas and innovation company AKQA, stated that "To run an efficient team, you need only three people: a Hipster, a Hacker, and a Hustler" (Ellwood, 2012). The idea is that the 'Hipster' brings creative talent and ideas to the project – and according to Ellwood "they'll make sure the final product is cooler than anything else out there," and the 'Hacker' is the technical- and detail-oriented talent, asking tricky questions and bringing ideas into fruition; the 'Hustler' is the commercially oriented money and/or salesperson finding the resources and backing to move towards a product to bring to market.

Whilst Inamoto's concept of an efficient team resonates with many in start-ups and larger organisations, for the creative freelancer, micro-SME or very early stage start up, the reality is often that one or two founders need to occupy all three Hipster, Hacker and Hustler roles or to have the skills and know-how to find and manage contractors, and perhaps additional founders or long-term team members, to fill gaps in their capacities. Doing so requires not only the 'hard skills' of data, digital and technical skills and literacies but also a range of 'soft skills' – the collaborative, business, professional, social and communications skills. Additionally these founders need to understand the business of their practice – whilst an element of these skills is now much more common in an art school education, it is also the case that new data-driven ideas and creative businesses, products, services, and experiences often, by their definition, challenge and disrupt existing business models which is only possible when founders hold a sufficient understanding of business models and financial planning but also audiences, markets and pricing.

Soft skills

The importance of 'soft skills' is well understood in the context of employment settings where skilled, trained workers are required to adapt to the realities and complexities of working collaboratively and across disciplines (Succi and Canovi, 2020). These types of skills can be particularly relevant for creatives who manage their own freelance employment or who run small or medium enterprises. Definitions and uses of the term 'soft skills' vary; it can be used to refer to either learned competencies, to a person's individual traits or underlying characteristics or both. Soft skills tend to be defined as generic, as opposed to specific skills required for particular tasks. They concern working directly with people rather than machines or technology and draw on interpersonal, social abilities and emotional understandings rather than 'hard skills', which refers to tangible, often technical knowledge (Marin-Zapata et al., 2022). There are benefits to defining the concept of soft skills in an inclusive and broad sense, encompassing ideas of ability, personality traits and competence – where a professional has become competent either through training or experience. However, this can also lead to difficulties in defining and designing training and support to fill any soft skills gaps.

The importance of providing mentorship and support to enable employees to gain these soft skills in order to work productively and understand aspects of workplace culture and practices is acknowledged (Fettes et al., 2020). However, for workers embedded within smaller-scale employment practices, alternative strategies must be deployed to fill these gaps in formal mentorship, in-house training and the peer-to-peer and informal learning that can be accessed when part of a large workforce. This applies not only to contextual, generic and soft skills but also to specialism-based skills that need to be kept up to date. Besides formal training provided by the further and

higher education sectors, informal training is often delivered through network organisations, industry bodies or trade associations or through in-house training of small creative organisations and companies in the creative industries who provide great learning and development opportunities for individuals but often cannot retain this trained workforce (Comunian et al., 2021).

We argue that the acquisition of 'hard skills' – of technical proficiencies in digital skills –needs to be complimented with 'soft skills', and attention also needs to be paid to the concept of both 'data literacy' and 'digital literacy' (Pangrazio et al., 2020). Freelancers in particular need to be able to understand the terminology and landscape of data and digital skills, even if they do not wish to acquire them all themselves, in order to be able to collaborate or work closely with others, such as technology specialists. The 'knowing about' (Parkinson et al., 2020) is thus a critical part of the soft skills and literacy requirements when the acquisition of hard skills is not feasible or preferable. This in turn aligns with the soft skills recognised as part of the collection of general entrepreneurial skills which are critical to innovation for creatives, freelancers in particular.

Looking back, in the UK much professional development training in the late 1990s and early 2000s was delivered through grassroots arts organisations, who "developed bespoke professional practice activity and expertise over a number of years" by providing accessible advice, signposting, personal development (soft skills) and technical skills training (hard skills) (Louise, 2011). The digital skills development at this time focused initially on marketing and sales such as use of social media and web (a-n Editorial, 2010), followed by preserving and archiving, operations, business models, distribution and exhibition and creation (Nesta, 2017) to digital production, rights clearance and data analysis (DCMS, 2018). Digital skills have thus moved from business skills acquisition to include more creative production skills as production technologies have become more available.

Although a significant amount of funding has been invested into the digital upskilling of the UK creative industries since the early 2000s (Unitt, 2019), with longitudinal studies by Nesta evidencing the role and impact digital technology is having for arts and cultural organisations and the concomitant skills requirements (Nesta, 2017) these have tended to focus on creative and cultural organisations rather than freelancers and micro-SMEs. The Department for Digital, Culture, Media & Sport (DCMS) – responsible for supporting culture, arts, media, sport, tourism and civil society across England – outlined the digital skills needs for the cultural sector from basic skills, managing information, communicating, transacting, creating and problem solving to specialist IT skills such as data analysis and programme and system design (DCMS, 2018, p. 31), informed by the Bazalgette Review (Independent Review of the Creative Industries, 2017). Notable digital skills capacity-building programmes did not directly target freelancers (Unitt, 2019).[5] In short, whilst many digital training and skills programmes in the past decades

have focused on upskilling cultural institutions and creative organisations, arguably freelancers have fallen through the cracks.

Changes to skills training since the COVID-19 pandemic

The global COVID-19 pandemic changed work practices across multiple sectors and highlighted significant and urgent need for greater digital skills and confidence with digital technologies. Amidst a wide range of UK government-level furlough funding, training and job placement scheme[6] responses to COVID, we discuss two notable interventions in Scotland, one immediate and focused on the creative industries and one longer term with strategic focus on start-ups across the Scottish economy.

In a rapidly deployed response to COVID, the Scottish government supported the £1m Creative Digital Initiative, delivered through XpoNorth,[7] to support Scottish creative and cultural SMEs and micro businesses to develop their digital capabilities. In addition, the Digital Pivot[8] programme managed by Creative Scotland[9] was more specifically targeted at supporting individual creative freelancers to explore the use of, and develop skills in, digital and creative technologies. The definition of 'digital' used in this programme is noteworthy; 'we're defining digital as the use of technology to connect people with content (not necessarily via the internet). Not to be confused or used interchangeably with *online* or *the internet*' (Glass, 2021, p. 5).

Looking more strategically and long term, the Scottish government commissioned Mark Logan, a noted technology founder and former chief operating officer of 'unicorn' startup (a privately held startup with a billion dollar+ valuation) Skyscanner,[10] to look at "how Scotland's technology sector can contribute to the country's economic recovery after the COVID-19 pandemic," resulting in the Scottish Technology Ecosystem Review, published in August 2020 (Logan, 2020). Several specific policy recommendations emerged from the report, including the requirement for a 'Tech-Scaler National Backbone' which would provide "long-term, affordable, high-quality incubation space" for start-ups and "free high quality foundational start-up education" (pp. 67–68). The Scottish government committed £42m in funding, and the Techscaler contract was awarded to CodeBase,[11] originally a technology incubator and now an organisation supporting technology start-ups and innovation. CodeBase are a core partner in the Creative Informatics programme, and we talk later about the training approaches developed for creative industries start-ups there, which have subsequently fed into this national-scale work.

We suggest that the need for training and skills acquisition which emerged in the wake of the pandemic accelerated a digital pivot which was already emergent but that this shift was also the result of policy interventions rather than only the grassroots-up emergence of professional training for creatives.

We note that the higher education (tertiary education) sector is moving into the space left vacant by grassroots organisations (due to changes in funding) as higher education institutions are often the mechanism through which these skills development priorities are now being delivered. The UKRI UK Creative Clusters programme[12] and Audience of the Future programmes, delivered through universities and research organisations in partnership with industry bodies, are key examples of this: the clusters support research and development activities through funding, and this is also accompanied by the delivery of informal or formal training programmes.[13]

R&D as a locus for skills and continuous professional development

Whilst skills and training are often funded as discrete activities through structured programmes or networks, R&D activities are also, in and of themselves, a form of learning and capacity building, although the literature addressing this tends to focus on R&D in the context of engineering and heavy industry (e.g. Sagar (2006) in the context of innovation in the energy sector). In their report, "Creative Futures: Building the Creative Economy through Universities," Atton (2008) argues that creative university education needs to incorporate 'learning by doing' and teaching that includes 'research-like' projects that foster greater entrepreneurial and business skills. R&D as a form of learning has particular relevance in the context of arts and creative industries where a significant proportion of (academic) design and arts research is *practice-based* or *practice-led* (Candy, 2011) in form. The training for many creative roles and careers, from fine arts and crafts through to software development for digital gaming, often takes a form familiar as a type of apprenticeship and guided and scaffolded multistage development towards a level of expertise, moving from working in lower-level production tasks through to mastery and creative leadership. The exploratory nature of R&D projects and experience of navigating unknowns in creative work clearly provides an excellent structure to support 'learning by doing' and practice-based training for creatives at multiple levels of experience, confidence, and prowess. Indeed, in their work on creatives in the Netherlands, Wijngaarden et al. (2019) characterised the role of innovation in the creative industries as a process of 'continuous renewal' and a core part of creative economic survival – drawing together key aspects of both R&D and day-to-day creative practice.

However, the lack of literature on R&D as a site for training and professional development for the creative industries may reflect wider challenges to understanding research and development in the context of the creative industries, reflecting the broader issues of sector-specific languages and cultures. In the context of cutting-edge science and engineering, research and development has historically been more easily recognised in terms of protectable IP

and technical innovation – something reflected in issues around broader definitions of R&D (Siepel and Velez-Ospina, 2022; Easton, 2022). By contrast, in the creative industries, research and development can be understood both in these more recognisable technical forms, but it is also the term used by, for instance, performers, writers, dancers, and so on in reference to the development to a new piece of creative work that – despite being new protectable IP – does not necessarily fit the classic science and engineering models around patenting and economic exploitation through licensing and scaling. These specific creative industries forms of research and development may also vary significantly in terms of technological sophistication and novelty, with many being about innovative adoption or forms of creative output. These variances in language and in the form and maturity in the type of innovation may be part of the reason that the crucial role creative R&D can play in development of skills and sector capacity building is often overlooked in the literature, despite the realities of developing new work in the sector. We therefore argue that there is enormous complementarity in providing an interlinked combination of structured training programmes, formal and informal mentorship, R&D for both innovation and capacity building, and scaffolding that provides a holistic framework for supporting the development of skills at multiple levels for the creative sector.

Engaging with technical specialisms

The emergence of the term 'CreaTech', used to describe the intersection of creative skills and emergent technology, demonstrates the importance of the rapid changes being experienced across the creative industries. Artificial intelligence and virtual production (VP) are examples of how this technological expansion is affecting creative production and the wider creative sector and creating a need for specialist, often technical 'hard skills' (Marin-Zapata et al., 2022). It is therefore useful to consider these areas in more detail with a view to how they might shape skills development and demand in the future.

The rise of artificial intelligence

Artificial intelligence and its potential for impact on society are now regularly reported on in the UK media.[14] Media stories oscillate between dystopic stories of jobs being lost and the utopia of an AI revolution that will usher in new jobs and opportunities that we can't yet imagine. Of particular relevance is work that details sections of creative sectors where AI is making inroads in areas once thought to be immune from mechanisation (Davies et al., 2020; Anantrasirichai and Bull, 2021). AI tools such as Midjourney[15] and ChatGPT,[16] used for image and text generation, are now available to the public and are being used in increasingly sophisticated ways. At a professional level, generative AI tools are being experimented with for innovative uses across a

range of creative industries. Against this backdrop of emerging innovations, there is a growing pressure, whether real or perceived, for creative practitioners to engage with the use of AI, or at the very least to better understand its potential for impact on the sector.

Extended reality and virtual production

Other technologies making a significant impact on creative production include extended reality (XR) and virtual production. XR is a term that includes a variety of technologies that blend our experience of the real world with that of the digital world or immerse us in a fully digital world. These can include equipment and applications that are becoming increasingly familiar, such as virtual reality (VR) headsets and augmented reality (AR) smartphone apps, as well as related emerging technologies that are still in development. Virtual production relates primarily to those in the screen industries drawing on opportunities offered by virtualising technologies to create digital environments. The field is evolving rapidly, making VP difficult to define precisely, but in their report, Willment and Swords (2023) define VP as

> a way of making film and television which harnesses computer generated content that allows real-time visualisation and control of the digital environment in which you are shooting. Importantly, virtual environments are captured 'in camera', rather than added in post-production.

This industry will require skilled practitioners with knowledge of computerised domains, many of which require not only skills and training but access to technical infrastructure on which to train and experiment in areas including lighting, animation, motion-capture, game engines, XR and LED volumes. In the UK, research and development investment in VP is evident through programmes such as the XR Network+ programme[17] which focuses on setting the research agenda, XRtists: Supporting the Implementation of Immersive Technologies,[18] which includes skills development, and CoSTAR (Convergent Screen Technologies and performance in Realtime),[19] a network of labs and studios supporting research and development, along with knowledge exchange and expertise. These programmes demonstrate the importance placed on the role of collaborative academic and industry R&D and the importance of upskilling in the strategically important film, TV and games industries for the UK economy.

Creativity support tools: bridging hard and soft skills

The range of digital tools available to creative practitioners has increased dramatically in recent years, along with the adoption of commercial cloud-based services offered by software providers. Initially these tools focused on

support for producing creative output. For example: Adobe Creative Cloud[20] designed to support media producers, photographers, illustrators and graphics designers and MicroStation[21] and Autodesk's AutoCAD[22] designed to support architects, engineers and product designers working in 3D and also widely used in the games and film industries. The impact of these tools on practice was to enable the creation of more sophisticated representations of ideas and concepts in a shorter timeframe. While formal education programmes at school, college and university levels include training in many of these packages, once a practitioner is qualified, keeping skills up to date becomes part of their own ongoing professional development (and often comes at their own expense). The challenge of maintaining skills is further complicated by the tendency within education to train in 'industry standard' commercial packages available through free or highly subsidised educational licenses (designed to build loyalty in emerging practitioners), which then cease to be accessible at discounted rates after the completion of courses, rather than training with open source equivalents (see e.g., McMahon, 2022). These technological shifts, along with the emphasis on self-directed learning, has increased the requirement of practitioners to become digitally literate irrespective of whether their own creative output has been created wholly or partly using digital tools. In their discussion of the challenges inherent in managing digital transformation in companies, Caputo et al. (2023) assert that, "the weakest factor is the human dimension itself. Indeed, mastering digital transformation requires organisational change and involves a more careful exploration of the human side of change." It is challenging enough for large organisations to support diverse and varied skills within a workforce, but for small and micro businesses, and individual practitioners, the challenge is greater still.

While ideas and theories around novel technology use and acceptance are widely researched within information systems research, there is less focus on the acceptance and adoption of these technologies specifically within the creative industries (Rahimi, 2020). In the research domain of human-computer interaction (HCI) the design, adoption and use of these types of tools, referred to collectively as creativity support tools (CSTs), has been the subject of study. For example, Frich et al. (2019), provide an overview of the range of types and applications of CSTs addressed in HCI creativity research, mentioning the wide diversity of types of tools available, aimed at a range of users from novices through to experts. Investigating the use of technology adoption by creatives, Palani et al. (2022) found that practitioners most frequently mention personal recommendations from friends, collaborators and social connections when discovering tools to adopt. This emphasises how important it is to support and promote networks and communities of practice where creatives can share this knowledge. As Ben Shneiderman wrote in 2002, 'the goal of designing creativity support tools is to make more people more creative more often, enabling them to successfully cope with a wider

variety of challenges and even straddle domains' (p. 116). Shneiderman's article stresses the social nature of creativity, emphasising the importance of consultation with others throughout the creative process, including peers and mentors, and dissemination of results for the benefit of other practitioners (Shneiderman, 2002).

Reflecting on developing new R&D-oriented training and development structures for capacity building in the context of Creative Informatics

We have discussed some of the characteristics, opportunities, barriers and challenges around both the current delivery and the conceptualisation of training and development in the creative industries. In the remainder of this chapter, we reflect on the experience of developing and delivering a new complex structure for training and development in the creative industries with a focus on R&D and innovation around data and data-driven innovation for the Creative Informatics programme (2018–2024). We present the following discussion as a collection of key learnings and observations rooted in experience from this publicly funded programme which sought to build capacity through activities offered within a focused regional cluster.

Overview of Creative Informatics structures supporting informal learning

The Creative Informatics programme offered a range of mechanisms to support networking and informal, peer-to-peer learning alongside both structured training and R&D activities to develop capacity for work with data and data-driven innovation. The five-and-a-half-year programme, part of the AHRC Creative Industries Cluster Programme (see Chapter 2 for details), was aimed at the local community of creative practitioners in Edinburgh and the southeast of Scotland, with the goals of introducing and inspiring curiosity about approaches to data-driven creative work.

Earlier we discussed the idea that the ideal startup needs "a hipster, a hacker and a hustler" to succeed, something which the Edinburgh region already had through established communities of artists and creatives (particularly given Edinburgh's relationship to world-leading festivals), huge volumes of technical expertise emerging from universities and industry and a well-established finance sector. Into this context Creative Informatics sought to develop new opportunities for the creative industries by encouraging and enabling better connections, opportunities for dialogue and understanding and collaboration between creative, technical and business expertise through a range of interventions and support mechanisms, including: (a) events, workshops and other accessible awareness raising activities, including CI Labs, CI Studios and Innovation Showcases; (b) formal industry-led digital

start-up training through structured training and skills offerings, primarily a ten-week pre-accelerator programme, Creative Bridge, delivered by industry partner CodeBase and discussed in detail in the case study accompanying this chapter, complemented by funded placements on shorter and earlier stage training courses; (c) structured R&D funding strands for data-driven innovation, including collaborative inter-industry partnership projects (Challenge Projects), industry–academia collaborations (Creative Horizon Projects) and professional development through R&D (Connected Innovators, delivered by membership organisation Creative Edinburgh and Resident Entrepreneurs), as well as equality, diversity and inclusion–oriented R&D investments (Inclusive Capital). These planned programme strands were augmented by a range of support, formal and informal learning, peer learning and scaffolding approaches, as well as parallel small grants for engagement and development of academic researchers.

Stimulating and scaffolding engagement in skills development and R&D

In seeking to bring diverse communities together to create new work, Creative Informatics first had to find methods to convene these individuals and support them to explore and understand each other's practices with a view to the cross-pollination of ideas and potential new interdisciplinary collaborations.

CI Labs[23] were a series of (initially) monthly events (23 in total at the time of writing), attended by between 50 and 100 people, that provided a meeting place for creative industries professionals from diverse disciplines and backgrounds, as well as those working with data and technology, to come together. They typically featured talks, demonstrations and/or live performances from creative practitioners and academics working with data and data-driven technologies in order to showcase inspiring creative work with data and support a broader understanding of what 'data-driven innovation' means. CI Labs usually followed a theme and/or were curated in partnership with host creative organisations and venues across the city.

The events were designed to reduce barriers to participation by being held in the evening (accessible to creatives who manage parallel day jobs and creative practices), were free to attend and catered (accessible to all income levels) and designed to be slick and appealing in order to reach wider creative audiences. Whilst designed to work as in-person experiences, the format was developed and offered online then in hybrid form during COVID-19 lockdowns and the early post-lockdown period. By showcasing a diverse programme of creative data work, the events encouraged participation of audiences from creative and technical backgrounds to consider the possibilities of work with data and new data-driven technologies and to become more familiar with unfamiliar approaches. At the outset of the programme in particular, these events enabled connection with both the easy-to-engage early adopters of technology and

those with much more nascent interests or ideas in expanding their practice to take initial steps to navigate interdisciplinary work. Having access to understand what could be possible with a data-driven approach, and to understand *how* these new forms of creative work were produced and developed, helped participants to reduce fears of engaging in unfamiliar domains and see pathways to potentially engaging in new forms of creative work.

Annual Creative Informatics Innovation Showcase events[24] extended the Lab context to a larger (100–150 people) day-long event with emphasis placed on highlighting R&D work and individuals supported by the programme, enabling the local creative community to see themselves and the work of their peers reflected in a high-profile event alongside external speakers and thought leaders. These exposure and awareness raising events were intended to draw participants to develop new ideas and did, in practice, lead directly to participants applying into training, funding and support strands to take those ideas forward.

During the COVID-19 lockdowns, when initially all events had to be paused, the Creative Informatics team partnered with Visual Arts Scotland (VAS) to host Friday Forums, weekly online community events that, with some similarities to CI Labs, sought to highlight data-driven creative work. The partnership with VAS was intended to be a rapid response to COVID which would support vulnerable artists and, whilst there remained a focus on data-driven work, this was often working with an expansive definition of data which drew in audiences who would not have previously considered data or technology in their work (reflecting the wider shift in needs and practices discussed previously), many of whom went on to explore this through funded R&D projects. The pivoting of our events also became an opportunity for digital skills development for the sector itself, through resources on online and hybrid events[25] and accompanying training sessions.

Alongside the larger CI Lab events, 23 smaller CI Studios[26] were hosted as hands-on events, typically for 10 to 20 participants each. CI Studios were regular, informal events open to creative practitioners, presented both in-person and (during COVID-19 lockdowns) online. They aimed to provide opportunities for creatives of all disciplines to explore new approaches and to try working and experimenting with data and emerging technologies in a friendly, practical environment. The choice of themes for the studios was responsive to suggestions from our community and audiences (collated through feedback forms, partnership forums and informal feedback), with sessions including building chatbots, digital music making and data sonification, coding and no-code, climate data and green making and 3D scanning. Studio events were intended to be introductory and informative and to enable peer collaboration and knowledge exchange. The events were free and open to anyone to attend and were designed to offer benefit to both novices as well as creatives with more experience.

Beyond these events, the Creative Informatics team also set up access to supported physical infrastructure for further skills development and networking. For example, E11, an informal studio space at Edinburgh Napier University, was established to offer creative practitioners a range of state-of-the-art technology equipment (e.g., VR headsets, robotics kits, video equipment, directional audio, lidar, motion capture and 3D scanning) with which to experiment, along with support for using this equipment. Similarly, Inspace, a public engagement gallery at the University of Edinburgh, was upgraded with Inspace City Screen, a multi-screen exhibition space,[27] and additional fabrication equipment to facilitate prototyping and exhibition of new works.

Providing access to these scaffolded awareness and experimentation environments was intended to enable practitioners to explore the potential of data and new data-driven tools and to discuss how other creatives have integrated them into their own practice, both in terms of output and process. By doing so, the goal was to increase data and digital literacy and place a greater degree of agency in the hands of creatives, supported by their peers, when they make decisions about whether and how they can engage with digital tools.

The role of the Creative Informatics team in these event and exploration spaces was as hosts, both in the literal sense and in the more important sense of scaffolding participant experiences by welcoming people from diverse practices and backgrounds into a collaborative space with safety and support, not only facilitating networking and informal peer-to-peer learning but also through brokering specific new relationships across the communities present. These hosting and brokering roles, whilst publicly visible in these spaces, was also a key feature of often more one-to-one scaffolding activities for the community across the scope and lifetime of the project.

Scaffolding R&D for skills development and capacity building

We noted that the events, hands-on workshops and convening of community spaces discussed in the previous section were intended to support skills development as well as to stimulate engagement in R&D strands. All Creative Informatics R&D funding was offered through open funding calls (approximately 30 calls in total across the programme), with projects selected by a panel including external participants. A key feature of these R&D and our training strands was the expectation that participants would not be limited to participating in just one project but might move between funding strands as their practice and business developed, for example, starting with participation in the Creative Bridge training programme and then moving onto propose a new product, service or experience through the Resident Entrepreneur strand and/or responding to industry needs through the Challenge Project strand.

Rather than explore each strand in detail, here we discuss the key scaffolding mechanisms integrated into these processes to support skills development through these R&D projects and selection processes towards wider capacity building in the region for creative data-driven innovation and entrepreneurship in the sector.

Across funding strands, the following scaffolding tactics were offered and developed in response to the needs of the community:

1. Open calls with clear, documented criteria, processes and timelines
2. Funding workshops and application support (including support for those with additional needs)
3. Detailed and supportive communication of outcomes and feedback
4. Contractual support and ethics guidance
5. Brokering of relationships and signposting of tailored support
6. Reflection and reporting mechanisms to evidence development and impact
7. Follow up guidance, support, referrals and advice on further funding.

The Creative Informatics programme had been designed to enable creatives to engage in data and data-driven technologies in order to access opportunities in the wider economy around data and digital work; however, in practice the barriers to this were not always as straightforward as technology awareness. Earlier we discussed the need for soft skills around collaboration and entrepreneurship, but in addition to these areas, having the time, confidence, and capacity to engage in funding processes can be a significant barrier to accessing the grants and investment that facilitate innovation. These scaffolding measures sought to lower these barriers by demystifying funding processes, particularly the reasoning for specific funding decisions.

There are two aspects of the scaffolding, both of which take their inspiration from formal pedagogical practices, that we think have particular relevance for future creative innovation programmes and the understanding of R&D as a learning process.

Detailed and supportive communication of outcomes and feedback

Whilst many funding programmes seek to support skills development and stimulate innovative work, many of those applying are provided with only minimal feedback on the reasons for the success or failure of their applications. The anecdotal evidence from the Creative Informatics community (and others) is that this can be extremely demotivating given the amount of time required to complete application forms (particularly where applicants face other barriers such as neurodiversity that may make processes more time consuming and stressful). Whilst creative sector funding can be extremely

competitive, the often very personal nature of creative ideas and work, combined with varied and often minimal exposure to training in entrepreneurship and business skills as part of creative education, can make rejection particularly painful. Creatives may therefore feel disincentivised from further engagement in application processes, particularly if applying to interdisciplinary or technology funding where language and criteria may be expressed differently and/or reviewers may be less informed about creative work leading to particularly challenging feedback (where given).

In order to both improve the quality of applications (particularly re-applications), and to address these wider issues of skills, confidence and resilience, the Creative Informatics team took the view that all applicants, whether successful or not, would be provided with clear feedback on their application. Mirroring well-established pedagogic practices, this not only identified strengths and weaknesses but also provided guidance on areas for improvement, steered towards further resources or sources of support and very clearly indicated where the application sat in comparison to the assessment criteria and the other proposals received. This meant that an applicant with a weak and poorly aligned proposal would understand why they were being rejected and either how to improve their performance or why they would not be a good fit for this opportunity. More importantly, it gave near-miss applicants the confidence to understand the outcome of their application, what worked well, where their strengths were and how they might improve or develop their approach and a clear steer on the relevance of reapplying (and/or recommendations of alternative funding sources). Feedback was also used as a referral mechanism to other sources of training and support, particularly for identifying applicants who would benefit from the Creative Bridge programme to better develop their idea and their understanding of audiences, markets and business models for their creative work.

The provision of detailed and thoughtfully phrased meaningful feedback (and in some case follow-up conversations to query and further discuss that feedback) was deeply valued by the community, reflected in both formal and informal feedback mechanisms to the programme, and led to improved confidence amongst applicants to reapply and/or engage with other funders' processes. In several cases applicants were successful on their third or fourth attempt, with their confidence and articulation of ideas enormously improved between applications. This trajectory mirrors the progress seen in academic teaching contexts where students are provided with sufficient actionable feedback and are themselves motivated to take this on board to develop their understanding and skills towards improved performance. Whilst these processes are time consuming, they are also extremely impactful, as they are targeted and specific, unlike broader best practice offerings. Additionally, in improving the overall quality of applications over time, they also have a positive impact on the quality of projects funded and the motivation of reviewer panels. Building on this experience, we would recommend that organisations

and programmes funding and supporting innovation, particularly in the creative industries, review their own selection and feedback processes to consider how they might better use funding processes as a form of scaffolded learning through improved and more specific feedback that considers the perspective and investment of the applicant.

Reflection and reporting mechanisms to evidence development and impact

For those projects which were selected for funding, the Creative Informatics programme required a number of reports to capture the use of funds and impact of funding. Across most funding strands, these reports were tied to contracts so that scheduled payments would only be released on receipt and approval of midway or end reports. However, in addition to capturing a record of progress and certain required data sets for public funders, these reporting templates also included qualitative questions to stimulate project teams to reflect on their practice and learning and how their work had changed or developed, as well as feeding back on any support they had received. Again, this approach reflects well-established practices in formal education where self-reflection is a key element in an individual's learning process and where feedback processes are crucial to improvements in academic support. The purposes of this reporting process were clearly articulated to participants, with data from these processes (as well as from applications and wider programme data sources) reflected back to the community through partnership forums, annual reports and so on as part of wider transparent practices adopted to build understanding, engagement and trust amongst the community. As a result of understanding the purpose and intentions of these reports, the team found that, in most cases, funded projects engaged meaningfully with this process, taking the opportunity to reflect seriously as part of their own development.

For more collaborative projects, with multiple partners, these written reports were augmented by facilitated meetings to bring all partners together with the programme team to reflect, provide honest feedback and look forward to any further collaborative opportunities. Where collaborations had been more challenging or relationships more problematic, these were not always easy meetings but did provide opportunity to reflect, discuss and address issues, reflecting both industry practices around client/service provider relationships and educational best practices around peer feedback in the context of group projects. Including the Creative Informatics team as facilitators also enabled them to learn and reflect on the scaffolding and support provided and how it could be improved.

Building on our experience, we would encourage those supporting R&D in the creative industries to consider mechanisms to better support those undertaking R&D to reflect upon their experience, their learning and

how undertaking exploratory or innovative work has changed their practice and understanding so that they are better able to evidence and communicate their capabilities and development. We believe this has significant benefits for those participating project teams as they develop their resultant products or skills to market and/or as they seek to undertake further R&D funding or contracts, though such reflection also supports R&D support organisations and programmes to properly articulate their impact on the sector.

Conclusion: the Creative Informatics approach to skills support

The experience of the Creative Informatics programme in the provision of skills support and learning through R&D for the creative sector has highlighted two key points: First, access to informal skills learning requires multiple delivery formats; there is not a single solution to this complex and nuanced problem. The specifics of the creative sector, together with a rapidly changing technological landscape, raise particular challenges around how best to expose creatives to what is both available and financially appropriate. Once decisions about potential technology options have been made, these initial sessions should ideally be complemented by more in-depth skills development that is tailored to the need of a specific project. The timing of learning activities is also crucial; in order to be up to date and effective, they should coincide with the development of creative projects while also being sensitive to the time commitments of the practitioners. Activities should be flexible in delivery and prioritise peer support in order to maximise ongoing impact. The experience of the COVID-19 pandemic brought these requirements into sharp relief, as many of the planned activities had to be moved to an online format, requiring the team to reflect on the most effective way to support our community.

Second, the scaffolding of skills and learning through R&D processes is critical to supporting learning and the development of confidence in both undertaking innovative work and articulating newly gained skills and expertise. Offering scaffolding across a range of tactics alongside a programme designed to offer a range of parallel pathways through skills and R&D opportunities has been especially impactful; however across all programme structures, adopting meaningful feedback processes and more reflective reporting practices are recommended in support of achieving learning and capacity building through R&D programmes.

Informal skills support across any sector requires appropriate resourcing, and in that the creative sector is no different. The development, maintenance and legacy of active networks across the creative sector require appropriate financial support. While Creative Informatics operated for a period of five years and undoubtedly had a positive impact on the sector (e.g. see Upton et al., 2021, 2022; Osborne et al., 2022), a robust ongoing infrastructure

is required to continue and build on this work both to support individuals within each discipline and to build strong links across disciplines. The existing membership and support organisations serving this geographic area, such as Creative Edinburgh,[28] Creative Arts Business Network (CABN)[29] and Applied Arts Scotland,[30] need continued support in order to provide the right services across the whole creative entrepreneurial ecosystem. Additionally, further evidence-based research and evaluation is required – and is ongoing – in order to interrogate the issues we have raised and to inform decisions around the development of networks and support mechanisms for skills acquisition.

As we look forward to a post-pandemic world, where we are seeing both technology and employment models shifting rapidly, we see a clear demand and many opportunities for creative practitioners to engage with data and technology in new ways. However, to enable individuals to thrive, there is a need for those working in and supporting the creative industries to prioritise skills and training and to reflect on how capacity and confidence can be nurtured to meet current and future needs. We have argued here that taking a nuanced approach to supporting a connected range of hard skills, soft skills, hands on-experience through research and development and highly relevant applied work and connected networks of peers and informal learning – a complex tapestry rather than a focus on singular skill areas – is vital for the continuous development of those working across the creative industries and for the blossoming of new areas of the creative economy.

Notes

1 Those with (fewer than 10 employees or turnover beneath £632k: https://www.gov.uk/annual-accounts/microentities-small-and-dormant-companies
2 https://creativeinformatics.org/
3 http://jeniallison.co.uk/services
4 https://www.sxsw.com/
5 For example, Amb:IT:ion Scotland (2009–2014). https://www.hannahrudman.com/2012/07/makeithappen-with-ambition-scotland/. Building Digital Capacity of the Arts (2011–2012) with BBC and Arts Council England https://www.bbc.co.uk/pressoffice/pressreleases/stories/2011/02_february/08/arts.shtml. Sync programme (2012–2014) as part of Creative Scotland's Cultural Economy programme, the Digital Research and Development Fund for Arts and Culture (2012–15) supported by Nesta, Arts Council England and the Arts and Humanities Research Council (Nesta, 2013) and later rolled out across the UK via its devolved partners in Scotland and Wales (2013–2015). https://www.nesta.org.uk/blog/launching-the-digital-arts-and-culture-accelerator/. Digital Arts and Culture Accelerator (2016) with Nesta and Arts Council England and more recently the Digital Culture Network (2019–ongoing).
6 For example, the Kickstart scheme which provided funding to employers to create job placements for 16–24-year-olds. https://web.archive.org/web/20200902014953/https://www.gov.uk/government/collections/kickstart-scheme
7 https://digitalfunding.xponorth.co.uk

8 https://www.creativescotland.com/funding/funding-programmes/targeted-funding/digital-pivot-support
9 https://www.creativescotland.com/
10 https://www.skyscanner.net/about-us
11 https://www.thisiscodebase.com/
12 https://creativeindustriesclusters.com
13 https://audienceofthefuture.live/about/
14 https://www.theguardian.com/technology/artificialintelligenceai
15 https://www.midjourney.com/home
16 https://chat.openai.com/auth/login
17 https://xrnetworkplus.xrstories.co.uk/
18 https://www.ukri.org/blog/breaking-the-boundaries-of-immersive-tech-experiences/
19 https://www.ukri.org/news/uks-creative-industries-benefit-from-significant-funding-boost/
20 https://www.adobe.com/uk/
21 https://www.bentley.com/software/microstation/
22 https://www.autodesk.co.uk/
23 https://creativeinformatics.org/ci-labs/
24 For example, CI Innovation Showcase 2022. https://creativeinformatics.org/innovation-showcase-2022/
25 Creative Informatics Guide to Online Events. https://doi.org/10.5281/zenodo.3980961; Creative Informatics – A Toolkit for Digital Events. https://doi.org/10.5281/zenodo.6012621
26 https://creativeinformatics.org/ci-studios/
27 See https://www.designinformatics.org/posts-by-tag/?tag=Inspace-City-Screen
28 https://creative-edinburgh.com/
29 https://www.cabn.info/
30 https://www.appliedartsscotland.org.uk/

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CASE STUDY

Creative Bridge: industry-led digital start-up training for the creative industries

Creative Bridge was a ten-week, cohort-based education programme designed to introduce creative practitioners to start-up thinking, innovation and digital product development. It was delivered by CodeBase, the UK's largest, and one of Europe's fastest-growing, technology incubators (https://www.thisiscodebase.com/), as one of six Creative Informatics activity strands.

Since 2019, ten cohorts and a total of 220 individuals completed the programme, which centred around three learning outcomes:

1. Turning a creative idea into a sustainable business
2. Breaking down barriers to the start-up world by demystifying the jargon around tech entrepreneurship
3. Sharing toolkits and processes which empower creatives to respond to fast change and to cultivate resilience

Within the Creative Informatics cluster, Creative Bridge[1] was a first step for creatives looking to develop an early-stage idea, with the ambition of taking them from plan to pitch through the programme and equipping them with the tools to grow their idea beyond it.

Redefining 'success'

Cohort 2 alumnus Elena Höge founded mission-led indie games developer Yaldi Games[2] shortly after completing Creative Bridge. The programme provided teaching and collaborative exercises on key topics around entrepreneurship, such as market and customer research, with a natural progression through the duration grounded in templates like the Lean Canvas.[3] Höge credits this learning with providing the structure needed to grow an entrepreneurial mindset and build beyond the creative idea she had developed.

Embedded within Creative Bridge was freedom around the idea of 'success.' As part of the programme, attendees were encouraged to reflect on their aspirations, setting aside pre-defined expectations for start-up success. As participants spanned the Department for Digital, Culture, Media and Sport (DCMS) recognised creative sectors and beyond, these aspirations and creative backgrounds were varied. Across the programme, ambitions ranged from achieving high growth and substantial investment to making social impact, building strong communities and achieving personal stability.

As a pre-accelerator, Creative Bridge did not offer investment or set post-programme requirements (other than a first draft pitch deck), which gave

participants freedom to define their next steps. For example, Yaldi Games' first offering, *Wholesome Out and About*,[4] is rooted in social impact and connecting games that cross digital and analogue boundaries so users can connect and learn in real life, as well as virtually (Martin, 2021). For Höge, hearing from a variety of start-up founders throughout the programme allowed her to see that "I didn't need investment to get started. . . . I could just start" (Creative Informatics, 2020a). For Yaldi Games, 'starting' meant building a network and honing skills around pitching and business planning through funding applications. Höge could refer to programme resources, for example, revisiting the Markets session ahead of undertaking market research. She continues to be an active member of the start-up ecosystem, with many media and speaking engagements, and has been successful in a number of funding applications, including winning the Creative Challenge category at the Converge Awards 2020, a prize of £20k in cash and £21k in in-kind business support.

Equipping creatives with a toolkit of resources, best practices and frameworks allows learners to adapt and revisit topics at their own pace. Creative Bridge participants were empowered to continue their development outside the ten weeks, ensuring continued resilience and adaptability.

Weaving together an ecosystem

Creative Bridge featured contributors from globally successful start-ups as well as local talent. The Creative Informatics partnership has allowed networks from the creative industries, academic and tech entrepreneurship spaces to weave together a strong ecosystem. The programme highlighted the ways in which problem solving, critical thinking, adaptability, resilience, building engagement and working iteratively are essential to both start-up thinking and the creative industries.

Craig Fleming is co-founder of Centrline.[5] Designed for the performing arts, Centrline combines project, scheduling and data management tools to enable individuals and organisations to work together effectively. Craig took part in Cohort 3 of Creative Bridge and has since continued to grow Centrline's offering through multiple funding opportunities and major partnerships. Craig came to Creative Bridge with a background in the performing arts, experience in some aspects of building a business and a clear understanding of the key problem Centrline sets out to address. The move into the tech entrepreneurship space was a natural step, and throughout the programme, Craig realised "how many parallels there are between the two spheres" (CodeBase, 2021).

Building strong partnerships with creative organisations has been vital to Centrline's growth. They went on to secure £12k of Creative Informatics

Resident Entrepreneur funding, affording time and space to develop and connect with the sector, and were successful Creative Informatics Challenge Respondents, collaborating with National Theatre of Scotland on a data-driven project to map the company's touring activity – a key partnership in the development of their business. Craig credits Creative Bridge with "opening up pathways to the entrepreneurial and tech community . . . and [enabling] access to a wealth of knowledge and experience and information" (Creative Informatics, 2020b).

Building community

Creative Bridge was delivered in person at CodeBase Edinburgh, online during the COVID-19 pandemic and then took place in hybrid form. The programme continually placed peer support and interactivity at the forefront of its learning approach.

Across cohorts, collaborations have formed, team members have been recruited and ideas developed because of shared ambition amongst participants. During the sessions, founder stories and learning theory were supported with group discussion, workbook activities, presentation and peer feedback. In addition, there was a network of alumni support opportunities.

Both Höge and Fleming described themselves as people with a creative idea but uncertainty about how to build a business around it. For Yaldi Games, working in an "environment that was super nurturing and encouraging . . . is essential to grow and inspire entrepreneurship" (Creative Informatics, 2020a). For creatives unfamiliar with the tech start-up ecosystem, Creative Bridge built confidence, developed participants' strengths in their own creative practice, and inspired ambitions towards next steps beyond the programme.

For Centrline, being able to "understand and demonstrate your value" (Fleming, 2022) has proved a key skill when it comes to partnerships and investment. Working alongside a peer group created a safe working environment for Fleming to explore key questions and identify a sustainable business model and to understand how to test that model, thereby gaining "a really clear idea of how [their] business could work" (Fleming, 2022).

Conclusion

Over the course of ten cohorts, Creative Bridge developed according to the principles it taught by remaining flexible and adaptable to the needs of learners, to a changing environment and to an evolving start-up ecosystem. It offered a combination of structured learning time, peer support, tried-and-tested frameworks, first-hand stories and access to a diverse ecosystem of entrepreneurs.

Each of these tools has allowed creatives to break down, scrutinise and rebuild their ideas, bolstered by a free, focused and supportive space which amplified the skills already available to them and encouraged development of new ones.

Katherine Warren

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Case study notes

1 https://www.thisiscodebase.com/creative-bridge
2 https://www.yaldigames.com/
3 See, for example, https://blog.leanstack.com/ or https://www.oreilly.com/library/view/running-lean-2nd/9781449321529/
4 https://www.yaldigames.com/outandabout
5 https://www.centrline.com/

5

DIVERSITY AND INCLUSION IN THE DATA-DRIVEN CREATIVE ECONOMY

An analysis of Creative Industries Clusters Programme approaches

Suzanne R. Black, Orian Brook, Dave O'Brien, and Nicola Osborne

Abstract

What is the role of data in our understanding of diversity and inclusion in the creative economy? How can decision-making be supported by the available data we have about the different characteristics of those employed, and innovating, in the creative economy? Focusing on the activities of Creative Informatics and other clusters in the Creative Industries Clusters Programme, this chapter will establish the importance of attending to the intersection of race, class and gender in the creative sectors and show how data can inform our understanding of mechanisms of exclusion in creative occupations. It will particularly focus on what we know about the makeup of the data-driven cultural economy and make recommendations on what we must do to ensure that both a diverse workforce and audience can engage in digital aspects of the creative industries.

Introduction

The inequalities in who participates in and benefits from the creative industries are well documented (Brook et al., 2020; Carey et al., 2021; Creative Industries Council, 2020; Creative Industries Federation, 2017; Nwonka and Malik, 2018). Beyond redressing these inequalities, there is a clear business case for diversity in the creative economy, with diverse teams more likely to produce hit products (de Vaan et al., 2015) and diversity an important element in attracting new audiences (Wreyford et al., 2021). There is potential for data-driven approaches to help facilitate equality, diversity and inclusion (ED&I) in the creative industries, to the benefit of all. This chapter offers an

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introduction to inequalities in the creative industries and the measures that are being taken to quantify and address these imbalances. It then presents an overview of the ED&I approaches of clusters in the AHRC-funded Creative Industries Clusters Programme (CICP) as context for Creative Informatics' (CI) ED&I objectives, actions and outcomes with regard to data use. We then offer some thoughts on key issues in this area around data monitoring, how to measure efficacy and sector specific concerns like a reliance on freelance workers. Finally, we offer a robust set of recommendations for future implementation, including developing and delivering a data-driven approach to ED&I that is created in conjunction with the relevant communities; incorporating feedback and accountability; and making key decisions around monitoring, criteria, transparency, fairness, public funding and accessibility.

What do we know about inequality in the creative economy?

Inequality has become a major concern for policymakers and academics who are interested in the creative economy. Recent years have seen whole swathes of creative economy organisations, including the British Broadcasting Corporation (BBC), Creative Scotland and Arts Council England, the British Film Institute, UK Interactive Entertainment (UKIE) and British Academy of Film and Television Arts (BAFTA), alongside the UK's Department for Culture, Media and Sport, issue statements or enact formal policies to encourage diversity and address widespread inequalities in their sectors. Inequalities persist despite research that demonstrates that supporting diversity and inclusion in the creative sectors would bring benefits such as increased adaptability, a broader range of thinking and fresh viewpoints (Crook, 2016) and enable increased business opportunities, even regenerating towns and cities (Beckett, 2022), facilitating both economic and social activity.

In the screen industries, for example, there are well-known barriers to success based on race and gender (Nwonka and Malik, 2018; Nwonka, 2021; Dent, 2020; Wreyford, 2018). These barriers, and the associated acts of discrimination underpinning them, were given further prominence in the context of both #MeToo[1] and the Black Lives Matter[2] movements. Concurrently, key media organisations (BBC, 2018; Ofcom, 2022) have also begun to address socio-economic or social class diversity in response to both policy pressure and research findings (e.g., Friedman and Laurison, 2019). These three areas of inequality – class, race and gender – sit alongside the absence from the workforce of other key demographics. For example, discrimination against disabled people is another major and longstanding issue for the screen sector (e.g., Randle and Hardy, 2017).

These examples from the film, television and gaming industries that collectively constitute the screen sector are closely replicated across the rest of the creative industries. Whether music, performing arts, design, IT, museums and galleries, craft or publishing, all parts of the creative economy struggle

to be open to everyone irrespective of their class, race, gender, disability or other personal characteristics (Brook et al., 2020; Carey et al., 2021). Rather, notwithstanding the outliers of the IT and craft sectors, most parts of the creative economy exhibit, particularly in leadership roles, the dominance of middle-class–origin, able-bodied, white men.

The scale of demographic under-representations, alongside the discriminatory practices and career barriers that explain them, are made visible as a result of data and research. The long history of research on inequality in the creative economy (see Brook et al., 2020 for an overview of the more recent research) has seen various academic and sector partnerships designed to deploy research findings, whether quantitative, demonstrating the demographic imbalances in creative occupations or qualitative, often shedding light on hidden forms of discrimination.

In Hollywood, the USC Annenberg Inclusion Initiative[3] has worked to highlight the absence of women, people of colour and people with disabilities across major studios' cinematic and television products. In the EU, research programmes such as Developing Inclusive and Sustainable Creative Economies (DISCE)[4] have mapped the creative economy, and the stages of a creative career, to create recommendations for policy interventions. In the UK, projects such as the All Party Parliamentary Group for Creative Diversity's *Creative Majority* report (Wreyford et al., 2021) or the research by the Creative Industries Policy and Evidence Centre funded by the Arts and Humanities Research Council (AHRC) (Carey et al., 2021, 2023) and associated work with the Social Mobility Commission (Social Mobility Commission, 2021) used data to develop policy interventions to address workforce inequalities.

In the outlier sectors of IT and craft, while some dimensions of inequality may be reduced, others persist. For example, IT has a substantially higher proportion of people of colour in the workforce than other creative industry sectors or the workforce as a whole (Oakley et al., 2017), but analysis of the UK games industry census (Taylor, 2020) found that this over-representation was lower in the games workforce, especially at senior levels. The social class inequalities in both games and IT as a whole was as marked as in other creative sectors, and women were very substantially under-represented. This set of examples is by no means exhaustive. Indeed, the landscape is best characterised as one where data and research play a central role in the wealth of campaigning and mobilisation for change.

Of course, social inequalities in employment are not limited to the creative economy. Much of the initial work cited previously highlights how creative work demonstrates social inequalities on a similar scale to those seen in higher managerial and professional occupations such as medicine and law, despite the avowed left-leaning, liberal attitudes of the workforce (McAndrew et al., 2020) and the regret of those in senior positions in the sector (Brook et al., 2021). Social inequalities are also evident in the research and innovation sectors, prompting funding reassessments by UK Research and

Innovation (UKRI) and the British Academy of an Equality Diversity and Inclusion Caucus,[5] an interdisciplinary network of scholars led by Professor Kate Sang. They will work to identify, assess and share evidence on the effectiveness of current equality, diversity and inclusion practices in research and innovation across the humanities and science, technology, engineering and mathematics (STEM) subjects.

The very nature of an object of study such as 'the creative economy' is dependent on decisions about data categorisation and collection. This is important for two reasons. First, the long history of debates over how to define creative industries and the creative economy is intertwined with decisions that make visible, or hide, forms of inequality. Scales of measurement, occupational classifications and demographic data collection regimes are all as important as the choice to include industries that have high employment and significant gross value added (GVA) contributions within the definition of the creative economy. While the history of creative economy definitions has foregrounded the latter, the former have been crucial in understanding how the story of the creative industries is as much one of failures over inequalities as it is one of economic success.

Second, an emphasis on data, and data collection, is important in the context of the analyses of the creative industries organisations discussed in this chapter, which form part of the AHRC's Creative Industries Clusters Programme. The CICP, and the associated UK government industrial strategy and sector deal (Department for Business and Trade and Department for Business, Energy & Industrial Strategy, 2017) of which it was a part, were both underpinned by analysis of the potential of the creative economy to provide growth and employment. At the same time, questions of *who* made up the creative workforce were marginal in comparison to the focus on (place-based) economic growth. As a result, the organisations discussed in this chapter had scope to develop their own approaches to equality, diversity and inclusion without central policy guidance. Part of this chapter's analysis reflects this process of how the case studies relate to the underlying problems of inequality across the creative economy, particularly as these problems were not the highest-profile focus of the overarching sector deal; it also reflects on how they used data-driven approaches in this context.

Equality, diversity and inclusion in Creative Informatics

In this section we introduce CI's approach to ED&I. This includes objectives around inclusivity, representation, accountability and commitment to ED&I, and monitoring and ongoing improvement, as well as how our actions met these objectives. For more detail about the Creative Informatics project and its activities, see the introduction (Chapter 1) and Chapter 2.

ED&I statement and action plan

CI's ED&I ethos and plans for action are laid out in two key documents – the 'Equality, Diversity & Inclusion Statement' (Creative Informatics, 2021) and 'Creative Informatics Equality, Diversity, and Inclusion Policy & Action Plan 2021–23' (Osborne et al., 2021) – and these are followed by the publication of ED&I data in the report 'Creative Informatics Annual Report 2022' (Creative Informatics, 2022). The 'Equality, Diversity & Inclusion Statement' introduces CI's ED&I priorities, which are to "be a safe and approachable space for everyone, regardless of background or status," "provide additional support to help reduce barriers to participating in Creative Informatics events, funding strands, etc." and be held accountable (Creative Informatics, 2021). This statement also introduces the more comprehensive Policy & Action Plan 2021–23 (Osborne et al., 2021), which lists the following four ED&I strategic objectives:

> Ensure the programme is open to all and reaching the diversity of creative communities across Edinburgh and southeast Scotland.
>
> Ensure Creative Informatics represents or exceeds a representative proportion of participants from diverse backgrounds.
>
> Make our commitment to ED&I visible and open to all, ensuring the full range of our communities feel welcomed and included.
>
> Ensure monitoring is in place and that Creative Informatics is held accountable for our ED&I aspirations.
>
> *(Osborne et al., 2021, p. 2)*

We have gathered how Creative Informatics addressed these objectives into four sections, detailed in the following, which provide a road map that may be useful for other projects, under the categories: inclusivity (open to all), representation, accountability and commitment to ED&I, and monitoring and ongoing improvement.

Inclusivity (open to all)

Recruitment and communication

CI has sought to be inclusive to collaborators from many different backgrounds. This starts with messaging around who is welcome. This has included recruitment for the team and those delivering activities; selection of freelancers and other ad hoc paid contributors; outreach to stakeholders and partners; recruitment, application and selection processes for any funding rounds or support; and make-up of funding and selection panels. ED&I values also underpin key communications and engagement activities, such as programming of speakers and topics for events, particularly keynotes and those prominently promoted (moving beyond performatively adding a

panellist or contributor from an underserved community to an event that does not otherwise have an ED&I impact); promotion and communication of achievements and impacts to ensure they reflect the diversity of participants; and support offered to any applicants or participants, which may include making significant additional support available for those with diverse needs.

Scaffolding

Once individuals are brought on board to CI, sustained support is offered through "scaffolding" (Vygotsky and Cole, 1978). This spans a range of interventions requiring significant budgeting of staff time, including focused in-person and online pre-application workshops; one-to-one meetings, chats and pastoral care check-ins at times of heightened challenge; support for reviewing draft funding applications; offering flexibility or alternative support for those with additional needs; follow-up chats and calls to discuss detailed feedback; and support for participants in seeking alternative funding or support.

For many applicants the programme being run from a university has itself been an off-putting factor, as formal educational institutions, particularly universities, can feel alien to those from diverse backgrounds, particularly less privileged individuals, and so there is a requirement for proactive engagement to address those barriers and concerns. We have found that this support and opportunity to develop proposal-writing skills, to understand funder decisions and to interpret critical responses to their ideas have been particularly helpful for applicants who may have previously encountered barriers in the application process.

Projects with ED&I relevance

For our funding calls, this inclusive ethos applies to reaching both a diverse range of project collaborators and funding projects that will benefit diverse communities. One project that has obvious benefits for collaborators with an ED&I perspective is the Resident Entrepreneur Scottie[6] and their collaborator the Fringe of Colour Film Festival 2020.[7] Scottie is an online ticketing service that, at the beginning of the COVID-19 pandemic, pivoted to providing content management systems for arts organisations to collect donations and tie this to accessing content. Fringe of Colour was one of Scottie's first arts partners, for whom they built functionality for the Fringe of Colour Film Festival 2020 website to make available their commissioned film content.

In addition, CI have funded projects designed to be beneficial to minoritised and disadvantaged communities. For example, Resident Entrepreneur Elena Zini and her company Screen Language[8] received funding for a project that developed a new way to deliver subtitles to individual users in cinemas.

Zini then pivoted to a new project to create an accessible website to improve access to audio described films. The Sound Cinema Project,[9] which launched in 2022, will not only benefit visually impaired film fans but also includes the community at many stages of the project: in the steering group, focus groups, providing feedback and potentially as staff for the service.

Representation

Data collection

In the Policy & Action Plan, CI discuss collecting ED&I monitoring data from applicants from the beginning (Osborne et al., 2021, p. 1) and regularly reviewing "which characteristics we collect data on and whether these provide adequate data to assess performance" (p. 4). The data collected include age, gender, ethnicity, sexuality, postcode (as proxy for socio-economic status) and, where relevant, disability and accessibility requirements and is always an optional element of applications and based on self-identification (p. 4). The data collected differs from the protected characteristics outlined in the UK Equality Act 2010 in several ways:

> We do not gather data on several official protected characteristics: religion or belief; gender reassignment (we ask participants to self-identify gender); sex (we do not ask participants to declare their legal sex, just their gender); marriage or civil partnership status; pregnancy and maternity status.
>
> *(Osborne et al., 2021, p. 11)*

Ethnicity data

CI have published data on the gender, race and age of the participants funded. Here we take the example of ethnicity data for CI and suggest how these figures have been attained. A target was set for funding 8.3% Black and minority ethnic individuals, which is the percentage of the population of Edinburgh identifying as being "Asian, Asian Scottish or Asian British" or belonging to "Other ethnic groups" in the Scottish Census of 2011.[10] The rest of the population of Edinburgh identifies with the categories "White – Scottish", "White – Other British", "White – Irish", "White – Polish" or "White – Other".[11] Against this target, CI reported that the percentage of funded applicants identifying as belonging to the global majority[12] were:

> For the Creative Bridge programme (building a digital product business at CodeBase): 12%
>
> Resident Entrepreneurs (individuals or teams developing a new product or service): 18%

> Connected Innovators (individuals within the creative industries developing a data-led project): 12%
>
> Challenge Responders (responding to challenges proposed by creative organisations): 9%.
>
> *(Creative Informatics, 2022, p. 10)*

These figures are consistently above the regional levels for global majority people in the community.

The CI team believes that the lower figure for global majority applicants funded through the Challenge Responders strand may be due to the types of respondents that strand attracted and other limiting factors. The Challenge Projects model looks more like an IT contract/consultancy framework for R&D and therefore tends to attract more IT-like companies. While UK IT is one of the most diverse sectors of the creative industries, this diversity is located in specific roles, for example, call centre workers, and regions, for example, London and major English cities, without necessarily carrying over to the available talent pools in the southeast of Scotland. Local talent pools can also be influenced by visa limitations for certain levels and types of roles.

By contrast the Resident Entrepreneur strand (which has very high global majority participation at 18%) has attracted a large number of applicants with international backgrounds and/or collaborators who chose to make Edinburgh and southeast Scotland their home and their place of business, some using their funding as part of application processes for entrepreneurial visas.

While all strands have had open application processes which are welcoming of applicants from all backgrounds, not all strands have appealed to the same types of creatives and start-ups. Additionally, only some of the selection processes have included diversity monitoring as part of scoring processes, depending on the criteria of the funding round.

Benchmarking

There are excellent best practice guidance examples on ED&I, but, with many of the creative sector exemplars coming from organisations based in London or North America, assumptions around the types of diversity and underrepresentation can be inappropriate to a specific local context. We have therefore used both Scottish Census and Scottish Index of Multiple Deprivation (SIMD)[13] data, as well as wider Scottish creative and tech sector data, which are useful for understanding the baseline population we are working with.

Economic inequalities

In the UK, class or social mobility emerges as a key barrier to equality, diversity and inclusion (Brook et al., 2020), with the proportion of people with

a working-class background involved in the arts declining (Tapper, 2022). Indeed, CI are working in a context where socio-economic diversity is a more major challenge. However, data relating to class is notoriously difficult to collect, and proxy measures, such as postcode data – which can be used to indicate the overall prosperity and education level of geographic areas – are used instead.

Creative Informatics have begun to map socio-economic inequality using the SIMD, which is a resource created by the Scottish government to assign a relative measure of deprivation across the categories of income, employment, education, health, access to services, crime and housing. This initial work, led by Dr Uta Hinrichs, has involved gathering postcode data from those who have applied for funding strands, both successfully and unsuccessfully. Figure 5.1 shows this data across the Creative Bridge, Resident Entrepreneurs and Connected Innovators strands.

As can be seen from the aggregated data across the three strands, the majority of the applications came from, and the funding was awarded to, participants from the least deprived areas. Further examples of work exploring the insights of socio-economic data – in conjunction with other data types – can be seen in the case study 'Mapping the Creative Industries' that accompanies this chapter, page 124.

Accountability and commitment to ED&I

ED&I activities do not end with the publication of a statement of intent, setting goals or collecting data. The activities and use of language across a project or initiative need to consistently reflect its shared and stated ED&I values, remaining flexible to adapt to new knowledge or circumstances.

Changing needs

While working with individuals and SMEs through the COVID-19 pandemic, CI learned the extent to which circumstances and needs may change radically over time. Needs arising from physical disabilities, long-term health conditions, mental health conditions and caring responsibilities are always subject to change. During the pandemic, additional challenges arose for many participants, including those who did not previously identify as requiring additional support needs. During this time, we learned the need for flexibility and compassion in both practical delivery mechanisms and in communicating with participants, especially vulnerable participants.

For example, a formalised process for project alterations was introduced to enable participants to articulate their needs and realistic timelines for delivery.[14] This emerged in response to the majority of project participants needing to immediately rethink projects and timelines due to lockdown.

FIGURE 5.1 Creative Informatics SIMD data. This image is reproduced with permission from Dr Uta Hinrichs. *(Light grey circles = applicants funded, dark grey circles = applicants, size = volume)*.

However, this has continued to be a productive approach post-pandemic as the formal process gives participants confidence in agreed new timescales rather than feeling they are behind original dates. This approach benefits all, but we believe it particularly benefits those where diverse characteristics may be the cause of wanting or needing to amend plans by making this a mutually agreed-upon professional change, rather than a discretionary individual decision.

Monitoring and ongoing improvement

Feedback

Creative Informatics implemented a range of methods to monitor how we were meeting our objectives. This included the inclusion of general comments boxes on feedback forms for events and application process and in formal project reporting templates, enabling participants to note particular strengths, weaknesses and wider comments on their experience. These have frequently surfaced ED&I-related lessons for the team, who review such reports on a weekly basis for practical and reflective purposes. We have also implemented the inclusion of ED&I related open questions in relevant surveys; ED&I conversations as part of community engagement and events; and sharing and reflection on anecdotal feedback within the team, which can then inform more structured follow-up or reflection. Such open processes benefit the wider project and particularly enable ED&I issues to be raised in safe open spaces.

Partnership forums

CI consulted with peers and the wider community at a series of Partnership Forums held in person and online, which were open to all and designed to share updates and seek feedback from the CI stakeholder community. ED&I data on the programme are routinely shared as part of these events in order to hold the programme accountable to its stated objectives to be open and inclusive. These events allowed participants to surface issues like the difficulty of attending physical events (due to travel or childcare), difficulty of attending online events (due to inequalities in internet access), how to consolidate existing conversations, holding CI accountable to stated intentions and using inclusive terminology. Some of these suggestions have led to actions described in the CI Policy & Action Plan (Osborne et al., 2021), such as aiming to recruit a diverse range of speakers for events and conducting a consultation with dyslexic stakeholders on how to make application forms more accessible.

CI's experience has been that some of the most productive and informative feedback has come through informal and anecdotal routes, particularly feedback from potential applicants facing barriers, personal concerns or a specific

need for support on application processes. This feedback has directly fed into the design and improvement of processes, application forms, communication (including terminology, timing, formats and platforms), the ED&I Policy and Action Plan (Osborne et al., 2021) and the work undertaken by the programme delivery team in supporting applicants, participants and the wider community.

Equality, diversity and inclusion in the Creative Industries Clusters Programme

Several of the other clusters in the CICP have made publicly available materials relating to ED&I that describe their plans, activities and results. In this section we give an overview of the approaches of Bristol + Bath Creative Research + Development,[15] Clwstwr,[16] XR Stories,[17] the Screen Industries Growth Network (SIGN)[18] and the Creative Industries Policy and Evidence Centre (PEC).[19,20]

Bristol + Bath Creative Research + Development

Bristol + Bath Creative Research + Development is a cluster made up of the University of the West of England, Bristol, Bath Spa, the University of Bath, the University of Bristol and the digital creativity centre Watershed to support local creative industries. Their approach focuses on collecting data about its workforce, with an emphasis on seeing beyond statistics "to consider the experiences of people who are often left out of the 'diversity' conversation: people with disabilities, Indigenous people, caregivers, autistic people, those with intersectional or liminal identities, and many others" (Barron, 2021). In addition to rethinking the relationship between diversity monitoring and representational goals, they also institute a new measure, "belonging," since "the balance data was only half the picture – it only told us who was there. It didn't give us insight into how people felt and whether or not they had a sense of belonging" (Barron, 2021). In line with this, Watershed have published the report 'State of Play Data Results December 2021', which provides balance statistics for the steering board, executive team, delivery team and funding beneficiaries (Bristol + Bath Creative R&D, 2021), as well as a staff survey on belonging (Watershed, 2021). Bristol + Bath eschew representational targets, as such an approach "separated the aim of the building of belonging in teams" and "elicited a sense of false achievement" (Barron, 2021), although their approach still involves data collection and use.

Clwstwr

Clwstwr, led by Cardiff University in partnership with the University of South Wales and Cardiff Metropolitan University, supported by BBC Cymru Wales, Arts Council of Wales and Cardiff Council, and also funded by the

Welsh government through Creative Wales, focus on research and development in the news and screen sectors of media production in South Wales. Clwstwr's approach is more typical of organisations in the creative industries in following a data-driven approach of collecting data about the projects they fund and seeking to exceed regional benchmarks for diversity. They collect data on the nine protected characteristics outlined in the Equality Act 2010 as well as caring responsibilities, employment status, geographical location and socio-economic background (Komorowski et al., 2021, pp. 2–3) and Welsh language. This data is benchmarked against Cardiff Capital Region data where available, then data for Wales, then the UK (Komorowski et al., 2021, p. 2).

In November 2022 Clwstwr published reflections on their ED&I activities (Fodor et al., 2022). In this, they enumerate various strategies beyond data monitoring, including appointing a dedicated inclusion officer and funding more projects led by diverse teams (p. 12). Clwstwr have also published the evaluative report '30 Opportunities for Optimisation: How R&D Funding Can Support the Sustainable Development of the Creative Industries in Wales' (Beverley and Ward, 2022), which presents lessons learned from the Clwstwr programme with regard to inclusion and sustainability.

Policy and Evidence Centre

The Creative Industries Policy and Evidence Centre provides independent research and policy recommendations for the UK's creative industries. The PEC is led by Nesta and is composed of a consortium of universities from across the UK (Birmingham, Cardiff, Edinburgh, Glasgow, Work Foundation at Lancaster University, London School of Economics and Political Science, Manchester, Newcastle, Sussex and Ulster). The PEC, understandably, take a data-driven approach to establishing shortfalls in ED&I practice and measures to rectify this, as "Despite growing momentum to address EDI in the workplace and in social impact work, the evidence base for what works remains limited" (Nesta, 2021, p. 3).

The PEC have published a series of reports on 'Advancing Equity, Diversity and Inclusion at Nesta.' Their March 2021 report identifies gender and pay gaps within Nesta as well as a staff that does not reflect the diversity of society (Nesta, 2021, p. 3). The report then sets out clear goals, targets, actions and measures of progress for 2025. The PEC use London-specific and UK data on representativeness (Nesta, 2021, p. 7).

XR Stories and SIGN

XR Stories, the cluster in Yorkshire and the Humber with a focus on R&D for immersive and interactive storytelling, works in partnership with the Screen Industries Growth Network, which is funded by Research England to support ED&I initiatives, skills and training, and provide business support

for the region's screen industries. They are focused on working with organisations within the screen industries to be more inclusive. In response to this challenge they set out a series of aims, objectives, values and governance (Screen Industries Growth Network, n.d.). These are accompanied by ED&I benchmark targets drawn from organisations such as the Social Mobility Commission and Stonewall and agreed by the BFI, BAFTA and the screen industry (Screen Industries Growth Network, n.d.).

Issues for discussion

The previous overviews of the approaches of Creative Informatics and those of other CICP clusters to ED&I reveal several common areas of debate. In this section we compare and note common themes and also differences to the issues of the place of data monitoring, how to measure efficacy and the creative sector's particular reliance on freelance workers.

Data monitoring

For the organisations discussed in this chapter, the core of their ED&I strategies is data monitoring, often for the purpose of measuring against local or national benchmark data. The report 'Creative Majority' arising from the All Party Parliamentary Group for Creative Diversity recommends that organisations "[p]ublish annual data on workforce demographics, along with pay, and pay gap data for key characteristics including gender, race, class, parenthood, and disability" (Wreyford et al., 2021, p. 161). It is notable that they recommend publishing *annual* data, as this allows for the comparison of data over time.

Benchmarking to national or industry data sources can allow for initial comparisons to be made but, as Bristol + Bath Creative Research + Development argue, true representation goes beyond hitting targets (Barron, 2021). While benchmarking diversity data to regional demographics can be useful – it can be a good indicator of where programmes are failing to connect with particular communities – representational demographics are a starting point rather than the end goal.

In a report about data practices in the creative industries Caitlin McDonald and Jennie Jordan (2023) raise issues with data collection from creative organisations not adhering to a set of data standards and therefore making comparison more difficult, as well as the short-term nature of many creative industries projects leading to a cycle of collecting data without having time to act upon it.

Measuring efficacy

Despite the energy devoted to undertaking activities to improve ED&I, evidence about which measures work is lacking (O'Brien, 2021). Efforts

by the organisations covered in this chapter to collect meaningful data, set targets and benchmarks, solicit feedback and work to continually improve, show the central role that collective evidence has in ED&I activities. But beyond data collection, challenges arise when ED&I measures designed to improve diversity and equality don't address structural inequalities (Brook et al., 2020, p. 215) but instead preserve a "somatic norm" of "White, male, middle-classness" in the creative industries (p. 191) by training underrepresented groups to be more like the norm rather than transforming the norm to include multiple groups and perspectives (p. 215). Brook et al. describe a situation where "There is a real danger that speaking about inequalities is a new way to marginalise and ignore them" (2020, p. 256) and highlight that making ED&I practices visible does not necessarily mean they are effective.

Freelance workers

One factor of the creative industries workforce that needs to be attended to is the large number of freelancers working across its sectors. Freelancers are essential to the creative industries, with creative freelancers making up around 32% of the creative workforce in Scotland and 16% of the UK creative workforce (Connell et al., 2022, p. 4). Creative freelancers have been challenged by the COVID-19 pandemic, Brexit and the rising cost of living in specific ways that are often not seen and not helped by existing policies, such as the Coronavirus Job Retention Scheme or the Self-Employment Income Support Scheme put in place by the government (Easton and Beckett, 2021, p. 4).

Research by the PEC argues that the issues faced by freelancers are compounded when considered along with background, gender and ethnicity, age, disability and caregiving responsibilities (Easton and Beckett, 2021, p. 4). Indeed, recent efforts to ascertain the needs of freelancers in the Edinburgh area found that 28.3% of respondents were parents who had to balance caring responsibilities and work (Connell et al., 2022, p. 29). Taking into consideration the creative industries' substantial reliance on freelance workers is essential to devising successful ED&I activities. See the case study 'Mapping the Creative Industries', page 124, for further work on the benefits and challenges of working with freelancer data.

Recommendations for implementing a data-driven approach to ED&I in the creative industries

In developing the Creative Informatics approach to ED&I, the team have always been mindful of the challenges of ethical and appropriate data collection and use in this space. In the final year of the project the team were able to secure an additional £250k of funding from the AHRC to increase the impact of the project and specifically to make beneficial ED&I impacts. This provided an opportunity to, for the first time, directly bring ED&I aspects

into application scoring criteria, which is something we had previously chosen not to do. We also looked for strategies to reach key audiences, drawing on our evidence-based knowledge of people and projects supported to date. Both our experiences delivering the project as a whole and our specific experience of undertaking this targeted ED&I work have led us to further reflection and exploration of inclusive work. In this section, we share some observations built on this experience.

1. Developing a publicly shared set of ED&I values and buy-in of key stakeholders

As noted earlier in this chapter, CI created a detailed ED&I Statement & Action Plan (Osborne et al., 2021). Whilst ED&I monitoring and inclusive practices were important from the outset of the project, the trigger for making our approach visible and accountable was the rise of the Black Lives Matter movement as well as a growing awareness that a failure to openly share any position could be read as an implicit statement of disengagement with the issues. For organisations in comparatively homogenous population contexts, there is a particular need to be vocal in supporting those who may not be visible.

2. Actively delivering on ED&I values

The actions and values presented in our ED&I Statement & Action Plan (Osborne et al., 2021) led to concrete actions in, among others, the areas of recruitment, communications and responding to the changing needs of participants.

3. Capturing and actively making use of ED&I data

Whilst organisations can be good at capturing ED&I data, it is only useful if it is actively used, reflected upon, and informs the planning and delivery of new activities. Publishing ED&I data holds organisations to account and it is important to both share success stories and be honest about where there are opportunities to do better (and there are always opportunities to do better).

We therefore recommend the following:

- Seek out initial data on the underlying population in your location and/or subsector(s) in order to understand the addressable population as well as any particular characteristics and known equalities issues.
- Capture ED&I data at all stages of the project in a way that is consistent but mindful of shifts in terminologies, of participants' willingness to self-disclose ED&I characteristics and of the possibility that individuals may change how they identify or self-label over time.

- Explain why you are collecting ED&I data and how it will be used to make yourself accountable to your community and ensure they understand the value of sharing what can feel like very personal information.
- Review ED&I terminology, as it can be extremely dynamic and sensitive. We recommend consulting your community on how they want to be thought of and discussed but also (where necessary and appropriate) cross-referencing comparable definitions so that there is a shared and common understanding. Terminology may need to be updated over time, and these changes may impact on how you can interpret and present your data in the future.
- Ensure you are regularly reviewing your ED&I data and reflecting upon it at multiple levels: internally to inform day-to-day planning and delivery, regular funder and partner reporting, and stakeholder and audience reporting.
- Use regular ED&I monitoring to identify key gaps and opportunities for new initiatives and collaborations that can either be self-funded or used as the basis for new funding applications.

4. Ensuring you are held to account: involving the community in governance

We strongly recommend including the community in the governance processes for projects serving groups of stakeholders. Our twice a year Partnership Forums were advertised as open events with a shared agenda and discussion topics to inform participation. CI did not choose to ask the Partnership Forum to make specific decisions for the programme; instead they have provided a structure for consultation, accountability and iterative improvement of the programme that inform decision making. For projects seeking to develop and nurture communities that will become self-sustaining activities or structures, a more formal role in governance may be more appropriate.

5. Ensuring you are held to account: nurturing honest feedback at all stages

ED&I monitoring forms and processes provide significant and (typically) easy to analyse data to inform decision making; however, we also recommend seeking qualitative feedback on processes and performance even though it is harder to analyse.

6. Taking an evidence-based approach to ED&I

Conscious regular review of and reflection on both quantitative and qualitative ED&I data, particularly around key events or activities enables evidence-based shifts in practice, including how opportunities are being

communicated, how key stakeholders or partners are leveraged to correct for any significant emerging issues (e.g., the lack of a diverse funding applicant pool) and how future activities are planned and structured.

7. Meeting the community/communities where they are (not where you are)

We recommend any project seeking to engage with their community think extremely carefully about where and how you engage to ensure you are making yourself accessible and relevant to the communities you seek to work with, particularly when targeting communities with specific ED&I challenges.

Approaches we have found effective include:

- Holding events across a region and partnering with local organisations and venues to reach and connect your emergent community with existing communities and networks. Going to a community in their own space helps them understand an opportunity is for them or people like them. It also reduces barriers to participation arising from cost of travel, accessibility of travel and the psychological barrier of potentially exclusionary physical spaces. (See associated case study for more on location as a factor in community participation.)
- To reach underprivileged and underrepresented communities, we recommend seeking trusted organisations embedded in those communities and taking an open, collaborative and where possible long-term approach to developing relationships and initiatives that make use of but don't take advantage of their existing networks and trust. For CI we have partnered with the Creative Community Hubs project – itself a trusted network of embedded organisations in less privileged communities – in the delivery of our Inclusive Capital programme, and this builds upon several years of engagement with the team and their host organisation WHALE Arts.[21]
- Thoughtful use of both targeted in-person, online and hybrid workshops and scaffolding for potential participants and beneficiaries. Offering online routes to participation benefits those with caring responsibilities for whom travel costs and access or physical access or energy levels may be a challenge. Online events also have affordances that may benefit those with accessibility needs (such as automated subtitling and/or transcripts for those with audio impairments or for whom English is a second language). Such events need to have feedback and contribution mechanisms to enable remote audiences to participate equitably.

8. Scaffolding and support

Ensuring truly inclusive participation from a diverse community requires a significant commitment both to ED&I-informed processes and values and to practical methods to support and enable this participation. This includes

transparency and clarity of criteria and process, open recruitment for funding, provision of detailed feedback and an open dialogue with applicants.

9. Decide whether ED&I objectives are better served by being monitored or being a direct part of criteria

Where appropriate, we recommend considering making funding calls with a significantly targeted eligibility criteria and/or with ED&I criteria as part of the selection process. Sometimes either or both approaches will be appropriate; however, if undertaking the latter approach, it is crucial to be clear where elements of the application form are being captured for monitoring and where they will be disclosed to a selection panel to assess against stated criteria. Applicants may be comfortable sharing very personal ED&I characteristics on an anonymised monitoring form that they would not want to share in identifiable areas of an application seen by selection panels or funders.

10. Balancing transparency, fairness, public funding and accessibility

Publicly funded projects are required to be transparent and accountable in their processes, particularly when distributing funding. As part of that responsibility, most funders require extensive collection of data, and projects require sufficient factual and contextual information to both assess applications and monitor performance against project targets. However, long application forms and complex processes, even when clearly communicated, can be extremely inaccessible for groups, including those coming from less-privileged backgrounds, neurodivergent people and those with particular accessibility needs. In planning a project of this type, we therefore recommend giving consideration to the balance of needs for fairness and transparency with the needs to be inclusive and accessible and considering tactics to bridge these issues.

In supporting a diverse range of people, we recommend considering carefully how approaches that benefit one type of community may disadvantage others. For instance, for those with dyslexia, a video or audio submission may be significantly more accessible than a text form. However, video or audio submissions immediately make a wide range of diverse characteristics more evident to a selection panel, potentially subjecting applicants to unconscious biases, and can benefit applicants with a multimedia background and those with better access to filmmaking and editing facilities.

Conclusion

This chapter has looked at how challenges surrounding equality, diversity and inclusion in the creative industries have been addressed in the Creative Industries Clusters Programme, focusing in particular on Creative Informatics' approaches. While a data-driven approach is prevalent, it generates several

issues around effective data collection and monitoring, how to set goals and measure progress and how to create ED&I approaches that respond to the particular challenges of the creative industries.

There are many very significant challenges still to be addressed in improving ED&I in the creative industries. To this end, we recommend a reflexive and iterative approach that includes working with all the communities involved; incorporating feedback and accountability; and thoughtfully making key decisions around monitoring, criteria, transparency, fairness, public funding and accessibility. A proactive and data-driven approach, including regular reflection and accountability, and an empathetic approach to diverse groups of people and communities, can help in the development and effectiveness of inclusive work.

Notes

1 https://metoomvmt.org/
2 https://blacklivesmatter.com/
3 https://annenberg.usc.edu/research/aii
4 https://disce.eu/
5 https://disc.hw.ac.uk/edica/
6 https://creativeinformatics.org/participant/scottie/; https://scottie.io/
7 https://www.fringeofcolour.co.uk/
8 https://creativeinformatics.org/participant/screen-language/; https://screenlanguage.co.uk/
9 https://virtual.mysoundcinema.com/
10 https://www.scotlandscensus.gov.uk/search-the-census#/
11 These categories of ethnicity demographic data were established by Scotland's Census (2011).
12 We have used the term global majority to refer to "people who are Black, Asian, Brown, dual-heritage, indigenous to the global South, and or have been racialised as 'ethnic minorities' " (Carty, 2023) where previously the term BAME (Black, Asian and Minority Ethnic) may have been used, as this term is not preferred by the communities to which it is supposed to refer. We acknowledge that no term is perfect and that terminology around race and ethnicity is always evolving.
13 https://simd.scot/
14 This is modelled on the Information Technology Infrastructure Library (ITIL) concept of a Project Change Request.
15 https://www.bathspa.ac.uk/research-and-enterprise/research-centres/centre-for-cultural-and-creative-industries/bristol-bath-creative-rd/
16 https://clwstwr.org.uk/
17 https://xrstories.co.uk/
18 https://screen-network.org.uk/
19 https://pec.ac.uk/
20 While some of the clusters not included here (Business of Fashion, Textiles and Technology, Future Fashion Factory, Future Screens NI, InGAME, and StoryFutures) have engaged in ED&I activities like specific funding calls for inclusive projects and events or discussions around ED&I issues, they have not at this time published comparable materials like ED&I statements, diversity statistics or representation targets.
21 https://www.whalearts.co.uk/

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CASE STUDY

Mapping the creative industries: dynamic visualisations, literacies, and agency

To understand inequalities in the creative industries and address the imbalances found there, research that can dynamically visualise and explore these ideas is part of the process of measuring challenges and opportunities to work towards equality.

In the Edinburgh and southeast Scotland region, research which maps data about creative practitioners and cultural events geographically has shown how data can inform understandings and drive changes in approaches to creative practice and policy.

This case study includes two examples of mapping research projects that are data-driven tools for developing understandings of creative industries inequities and are also participatory in encouraging stakeholders to contribute to the maps and develop literacies and agency over the data that represents them.

In 2020 and 2021, Creative Informatics researchers Inge Panneels and Ingi Helgason created a map that aimed to understand and visualise the geographical spread and industry activities of individual creative businesses in the region. Previous research (Panneels et al., 2021) had found that freelance and self-employed workers – a group that is more prominent in the creative industries than in other economic sectors – are often underrepresented in available data. This mapping work aimed to promote ways to reach a collective understanding of the nature of the freelance and self-employed workforces in the region's creative economy.

In 2023, using data from the Edinburgh Festival Fringe box office, Creative Informatics Research Associate Vikki Jones was funded by the Data-Driven Innovation initiative (DDI) to work in partnership with the Edinburgh Festival Fringe Society to produce the 'Edinburgh Festival Fringe Open Audience Insights Map'[1] as part of the Edinburgh Culture and Communities Mapping Project, led by Dr Morgan Currie.

Mapping freelancers in the creative industries

The practice of mapping the creative industries began in the UK in the late 1990s, when the concept and construct of the 'creative industries' as an economic entity was recently established (Panneels, 2020). In 2010, the British Council published Mapping the Creative Industries: a toolkit, which presented mapping not only as the practice of mapmaking but as:

> shorthand for a whole series of analytic methods for collecting and presenting information on the range and scope of the creative industries. Mapping

> is intended especially to give an overview of the industries' economic value, particularly in places where relatively little is known about them.
>
> (British Council, 2010, p. 11)

In the case of Creative Informatics' mapping of freelancers working in the region, the way that Standard Industrial Classification (SIC) coding is employed by the UK government's Department of Culture, Media and Sport (DCMS) means that freelancers and sole traders often fall through a "data gap" (Panneels, 2020). In response, two maps were created, one using publicly available data derived from companies' SIC codes and a second using Scottish Creative and Cultural Industries (SCCI) codes (Panneels, 2020). Creative businesses were invited to check whether they were represented on the map and, if not, to add their data (Panneels, 2020).

The use of mapping and the visual result was a means to show how the data gap around freelancers and sole traders in the Edinburgh and southeast Scotland region might be closed and to "make visible" (Panneels, 2020) the role of freelancers and sole traders as part of a bigger creative ecosystem. The data on the map shows both the geographical locations of creative freelancers and businesses by postcode and local authority area, and the creative industries sectors they are part of, mapped both to DCMS and SCCI definitions. The maps were updated in 2021 and remain open for submissions to creative businesses at the time of writing (Helgason and Panneels, 2021).

Edinburgh Culture and Communities Mapping Project: the Edinburgh Festival Fringe Open Audience Insights map

Like the map of freelancers in the Edinburgh and southeast Scotland region, the production of the Edinburgh Festival Fringe Open Audience Insights map sought to 'make visible' the creative economies of the Edinburgh Festival Fringe, which takes place for three weeks around the City of Edinburgh each August and, in 2023, included more than 3,000 shows and over 52,000 performances (Edinburgh Festival Fringe Society, 2023).

Building on existing research and resources – including previous research with Edinburgh festivals as part of the Culture and Communities Mapping Project – this project sought to explore ways to address the challenge of making data about ticket-buying audiences at the Edinburgh Festival Fringe open and accessible, democratising access to data for Fringe artists, producers and audiences (Jones, 2023). It was designed to consider and document the process of making the Open Audience Insights Map, as well as to analyse the data it holds and presents. As such, the project explored the stories that could be told or supported by and through the map about the multiple value systems and economies that interoperate at the Fringe and how these were dispersed across the city.

For the Edinburgh Festival Fringe, the unique nature of its open access programme and its vision "to give anyone a stage and everyone a seat" (Edinburgh Festival Fringe Society, 2022) creates a multi-perspective and multi-stakeholder landscape of interest and investment in the festival (Jones, 2023).

The map shows information about Edinburgh Festival Fringe tickets sold through the Fringe box office only, to those whose registered purchase address was in an EH postcode. In postcode areas with high numbers of ticket purchases, these areas have been further broken down on the map to show variation in this data. It also shows Fringe venues over the period of data on the map (2017–2022), data zones from the Scottish Index of Multiple Deprivation (https://simd.scot) that show the most deprived areas in the region (bottom three deciles) and plots year-to-year changes in ticket buying in postcode areas (Jones, 2023).

In exploring the idea of open audience insights for the Fringe, we found huge potential for data-driven tools like this map that might assist decision making about the festival experience. Representations of year-to-year change in ticket-buying audiences offer insight into where promotion of the festival in certain postcode areas might have been successful in growing audiences.

Conclusion

Both projects explore and demonstrate the potential and challenging of using mapping as a tool for both research and participation in the creative industries. They share similar challenges, too in finding standards and in making visible what the datasets they visualise can, and cannot, tell us. The freelancers mapping project shows the shortcomings of government-level coding of the creative industries but relies on participation by creative businesses outside of these classifications to bridge that "data gap" (Panneels, 2020). The Edinburgh Festival Fringe Map includes only data held by the Edinburgh Festival Fringe Society and faces issues of granularity in the data in that complete postcode data has the potential to identify individual households and so, for ethical reasons, is not included (Jones, 2023).

However, in visualising these data-driven challenges for both researchers and for the creative industries, the maps included here make the case for using data about creative economies to explore new ways to tell their stories and address the economic, social, political and cultural challenges they face.

Vikki Jones

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Case study note

1 https://ddi.ac.uk/what-we-do/academics/previous-open-call-summaries/social-change-opencall/

6

DATA ETHICS IN THE DIGITAL CREATIVE INDUSTRIES

Encouraging self-reflection and best practices

Nicola Osborne, Caitlin McDonald, Padmini Ray Murray, Burkhard Schafer, and Melissa Terras

Abstract

Data-driven innovation offers incredible opportunities for the creative industries; however, it also raises complex questions and potential risks in terms of privacy, ethical business and employment practices, environmental impacts, and moral and civic responsibilities. There are often tensions between economic and creative pressures and opportunities and the need to engage with legal and ethical approaches which can minimise risk, ensure compliance, and also make a positive contribution to society. Given the rapidly changing nature of the application of technology in the creative industries, this chapter outlines key considerations, provides pointers to further resources, and frames guidance on data ethics to those using and developing with data within the creative industries. We stress that any creative activity – even an individual one – is part of a wider community and that it is the responsibility of those creating, using, analysing, and transforming data to ensure that they consider how data is collected, used, and reused; consent and privacy; data storage and information security; inclusive design; ethical business and employment practices; and the social and environmental impacts of data-led activities. Through a number of key examples, we recommend that a critical, self-assessment approach can ensure regular reflection and adaptation to a developing and changing area and introduce our self-assessment framework while stressing the need for accountability. We report on important themes which are emerging surrounding the approach to data ethics within the creative industries. Finally, we suggest that a reflective data ethics approach should become embedded into creative practice that involves any aspect of data to minimise unintentional harms in the production of new products and services.

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Introduction

Aspects of data ethics – principles, guidelines, and moral standards that govern the responsible collection, use, storage, sharing, and analysis of data – are becoming a pressing concern for the use of data within the creative industries and their activities. This is particularly because – by their very definition – the creative industries "are those based on individual creativity, skill and talent, or which have the potential to create wealth and jobs through the development or production of intellectual property" (ScotGov, 2020). Developing new and novel approaches involving data often requires experimentation and innovating in areas where there simply is no established best practice and often no real knowledge of the implications and potential harms of technological development, until further reflection or assessment is possible. This is often in tension with the race to market and the pressure to deliver within our capitalist economic system. The ethics of work with and involving data is a complex area and can bring in any number of issues that draw together aspects of philosophy and values, business practices, data handling, and technical affordances. In this chapter we take a broad view of data ethics in the context of creative industry innovation, considering both legally defined aspects such as data protection; equality of access; and equality, diversity, and inclusion (discussed in depth in Chapter 5) but also aspects embodying social values such as employment practices, ethics of business practices and environmental approaches.

There are a growing number of reasons creative industries should care about ethical practices, including brand reputation and sustainability. However, innovation across the creative (and other) industries is synonymous with novelty and disruption. Whilst that disruption can be a positive driver for change, it can also mean bypassing the due diligence associated with more traditional slower moving developments of products, services, and experiences. When this kind of disruption centres on data, including personal data, the track record for ethical practices has been mixed, and often negative. Whilst Cambridge Analytica[1] is the most notorious recent example and has triggered much reflection on the ethics of data science (Schneble, 2018), it is far from isolated, and in a post–Cambridge Analytica R&D environment, any innovation involving data is increasingly expected by both users/audiences and by regulators (e.g. the UK government Centre for Data Ethics[2] and Innovation and the expanding remit of the Information Commissioners Office)[3] to take a more considered and transparent ethical approach.

This chapter aims to outline key considerations for the use of, and development with, data within the creative industries while providing pointers to further resources. We suggest that taking a thoughtful and self-reflective approach can help professionals in the creative industries adapt to the ever-changing landscape if there are also mechanisms for accountability.

To support this, we introduce our self-assessment framework, which explores key emerging themes related to how data ethics is being approached within creative fields, helping prevent unintended negative consequences when developing new products and services. We also provide recommendations for practitioners, education institutions, and funders on the ways in which they can support the embedding of data ethics principles into activities in order to promote best practice.

Growing awareness

Much activity in the creative industries is reliant on, and building upon, data to shape content creation, build new user experiences, and design novel audience engagement. An ethical approach to the use of data within the creative industries is important for a variety of reasons, including social responsibility and the potential impact the creative industries can have to shape public opinion and behaviour; the building of trust between clients and providers, leading to enhanced audience engagement as well as enhancing reputation and branding, and therefore leading to potential increased revenue streams; legal compliance and the reputational and financial risks to both users and creators in breaching legal frameworks; and establishing integrity, trust, and professionalism. Adopting ethical practice as part of creative approaches has to be a conscious decision, given the late-capitalist approaches to value creation which encourage extraction of resources as a source for innovation (Suarez-Villa, 2012). However, it is also increasingly the case that an ethical approach is seen as a key value and 'unique selling point' by consumers (whether businesses or individual end users) (Cockburn et al., 2012), leading to certifications for broadly ethical approaches, notably B Corp status (a legal form of enterprise in the USA that requires certification of social and environmental performance; see B Lab, 2023).

Unfortunately, legal frameworks have often struggled to keep up with technological change (see Chapter 7). The emergence of enterprise solutions for AI (such as ChatGPT), and the potential embedding of any dataset created into training data for future AI, further stresses the need to adopt responsible and compliant data practices. There is also growing public, industry, and investor awareness of the importance of an ethical approach to data creation, analysis, storage, and reuse. For example, a pressing question, at time of writing, is how generative artificial intelligence will disrupt the creative industries, including its creation and ideation phases and relationship to bodies of previously created content, as well as future business structures, revenue flows, income streams, employment, and relationship to existing artistic practice (see Chapter 9, also Parra Pennefather, 2023). Yet, with most employed in the creative industries being sole traders or small and medium-sized enterprises (SMEs) (see Chapter 2), where is the capacity to upskill, understand, and navigate these rapidly changing issues or to identify

where they have the power or opportunity to make changes to their established practice? Where are principles and frameworks to ensure we build creative technologies while understanding their potential social, economic, and cultural impacts?

Public awareness of ethics in the context of data and technology is typically triggered by high profile cases of misuse, mistrust, or deeply problematic (if not always illegal) use and combination of personal data. There are regular news stories about the transformative approach to data which have negative, unintended consequences, from the racism, sexism, and fascism of Microsoft's Tay (Wolf, 2017), to ChatGPT as a major source of plagiarism (Cotton, 2023; Thorp, 2023; Sallam, 2023), to generative image-based AI as a disruptor to intellectual property (Guadamuz, 2023) and, by extension, employment in the creative industries (Cremer, 2023; Wolff, 2023); the impact of algorithmically driven systems on music consumption and production (Hesmondhalgh et al., 2023); and the use of prediction software by publishers to dictate which books will be commercially successful and worth putting into production (Wang et al., 2019). In the creative industries, the most common large-scale data ethics failures involve data breaches from commerce platforms, for example, the loss of personal data by Ticketmaster in 2018 (ICO, 2018a), although data-rich, profitable media companies are also targets for cyberattacks and leaks (Jarrett, 2017), and there is growing concern about the intersection of consumer systems with political systems and the security of health data, particularly around reproductive rights (Torchinsky, 2022). Small traders and individuals are very susceptible to digital asset loss and copyright infringement, particularly when sharing their work online (Topping, 2010), and this has been exacerbated by the development of generative AI systems that are trained on scraped data which does not respect artist's intellectual property rights (Vincent, 2023).

Legal frameworks versus ethical practice

Each legal jurisdiction will have its own frameworks in which individuals and industry are mandated to operate. In the UK context, there are key legal requirements that must be abided by, including the Equalities Act 2010,[4] Data Protection Act (DPA) 2018[5] (ICO, 2018b), Intellectual Property (Copyright and Related Rights) (Amendment) (EU Exit) Regulations 2019,[6] and potentially the forthcoming Online Safety Act.[7] Business awareness tends to be manifested in terms of these risks and related risk mitigation. The widespread public information campaign around the introduction of EU General Data Protection Regulation (GDPR) in 2016[8] (embedded in UK law through the DPA 2018) led to widespread awareness of the legislation and potential risk, even to small businesses, around data. The increased fines (from a fixed maximum of £500k (University of Bath, 2022) to "up to £17.5 million or 4% of annual worldwide turnover, whichever is higher" (ICO, 2023))

applicable post-GDPR have highlighted the potential business liability to funders, institutions, businesses, and individuals if something were to happen. (See, for example, the record GDPR fines levied against Amazon's use of data in advertising (Burgess, 2021) and Facebook providing access to personal data for political advertising via Cambridge Analytica (McCallum, 2022)). Additionally, the widespread use of cloud computing infrastructure and international microservices (including social media and e-commerce) can add a layer of complexity to compliance with local legislation, as some data transfers may be subject to multiple jurisdictions' requirements or rights to access data.

Legal requirements and penalties can help ensure some core ethical challenges are considered and addressed; however, compliance with the law is not enough to ensure a robust ethical approach. There is a danger of only conceptualising data ethics activities as necessary for risk management, promoting risk-averse behaviours. While ethical practices are concerned with ensuring that you do no harm, there can be additional benefits beyond mere compliance and minimising risk. The use of data can enable significantly useful and impactful new products, services, and experiences which reflect a more nuanced and holistic understanding of ethical practices – including but extending beyond the ethical handling of data. For instance, in addition to commercial applications, it should be remembered that data can also be used to develop non-commercial applications which may be particularly helpful for individuals and communities, including those with disadvantages, resulting in positive contribution to society. For example, entrepreneur Petra Matijevic (supported by Creative Informatics) developed a new platform and schema to connect multiple open and public data sources, which is now being taken forward by Scottish co-operative investigative journalism platform the Ferret[9] (where Petra is now journalist director) and used in investigations supporting deeper citizen engagement with policy and governance, such as investigations on finances, influence, and public life. Similarly, an ethical and data-driven approach to environmental issues may also provide opportunities for business sustainability. The Edinburgh Tool Library[10] (ETL) is a charity enabling members to borrow tools and access workshop space, peer training, and skills sharing around DIY. To manage and track loans, they use myTurn,[11] a widely adopted software system, but decided to develop new, richer data analysis (supported by Creative Informatics) to understand usage, social impact, and carbon savings associated with tool use (see also the case study attached to Chapter 11). This values and ethics-driven approach to data capture was intended to enable more strategic management of resources and a robust evidence base for demonstrating social and carbon impact to funders and stakeholders (e.g., evidencing that ETL saves around 180 tonnes of CO_2 per year).[12] As ETL decided to share this work, their data analysis tool has now been deployed (through myTurn) to more than 400 tool libraries/resource libraries worldwide – creating new opportunities for increased

efficiency, improved processes, and evidence of impact for fundraising, development of socially inclusive business models, and so on. These examples help to illustrate that consideration of data ethics and broader ethical implications can lead to opportunity creation.

Ethics of R&D

Creative industries' research and development processes – particularly within small businesses and micro-SMEs – do not typically involve structured ethical processes, unless there is an academic element to the work or they are required to comply with ethics-related elements of procurement processes (e.g., anti-bribery) or are working as suppliers into a more highly regulated field (e.g., medical applications). Larger-scale creative industries organisations may be more likely to undertake ethics considerations, particularly when they have chosen to implement internal or external ethics groups as part of their governance, though this is itself complex and highly disputed territory (e.g., Google's relationships with its ethical AI research team (Newton, 2020)). For small creative start-ups and SMEs working with data, individuals and/or small teams must rely on their own knowledge and capacity (or lack thereof) when considering the ethics of their work, use of data, business models, employment practices, and so on. For those working in highly regulated areas of industry (e.g., a marketing company working with alcohol companies or a design agency working with the pharmaceutical industry), they may have greater access to information and expertise on (some) areas of data and business ethics than those working in less regulated areas. This variable and often limited understanding of data and wider business ethics can present risks to funders, institutions, businesses, and individuals if something were to happen that causes harm, as well as impacting on trust, relationships, and expectations of their users/customers and stakeholders.

Related guidance

A variety of existing resources on ethical approaches to data may be relevant to creative industries practitioners, including those from the Association of Internet Researchers,[13] whose Ethics Guidelines promote primary ethical norms (Franzke, 2020) of "respect for persons, beneficence, and justice": values drawn from the Belmont Report, a foundational document when considering this space (National Commission for the Protection of Human Subjects of Biomedical and Behavioural Research, 1979). It should be noted that ethics relevant to the creative industries working with data, technology, and particularly AI and machine learning is an area of growing interest, with many intersectional aspects (in addition to those discussed here, see Appendix 2).

In 2020, the European Union's High-Level Expert Group on AI published their "Assessment List for Trustworthy Artificial Intelligence (ALTAI)"

(European Union, 2020), building on the Group's "Ethics Guidelines for Trustworthy AI" (2019) by presenting a self-assessment checklist. The checklist is based on seven key requirements to consider when evaluating the trustworthiness of artificial intelligence systems: human agency and oversight; technical robustness and safety; privacy and data governance; transparency; diversity, non-discrimination, and fairness; environmental and societal wellbeing; and accountability. Although it focuses on factors collectively contributing to the responsible development and deployment of AI technologies, this assessment list provides a framework relevant to data ethics, more broadly framed, to ensure that innovation respects human values, upholds ethical principles, and aligns with the broader interests of society. Likewise, the OECD's[14] Principles on AI (2019) and Beijing AI Principles (International Research Center for AI Ethics and Governance, 2019) provide useful conceptualisations of responsible technological development. Tahaei et al. (2023) are actively mapping current and future trends in this area. At time of writing, individual platforms and internet service providers, such as YouTube, are developing principles for responsible use of AI related to creative endeavours (YouTube Official Blog, 2023).

More specific to innovation, in 2021, the UK's Digital Catapult[15] produced their Machine Intelligence Garage[16] Ethics Framework (Digital Catapult, 2021). This provides a practical guide for SMEs and entrepreneurs to review the ethics of their products or services. Based on seven key high-level concepts, it focuses on the benefits of the product or service; knowledge and management of risks; responsible use of data; earning and being worthy of trust; promoting diversity, equality, and inclusion; open and understandable communications; and the nature of business models. Those interested in aspects of diversity, inclusion, and equity in the use of data will benefit from *Data Feminism* (D'Ignazio and Klein, 2023), which offers strategies for justice-centred approaches to data creation and reuse (their ethos extends to making this text available for free download in open access).[17] From an environmental perspective, the non-profit Julie's Bicycle[18] aims to mobilise the arts and culture to take action on ecological crisis, providing practical tools (case studies, research, podcasts, and guides) as well as support on how to take climate action, including specific guidance and a data collection template on how to report on environmental data (2023). Their 2022 report, "Creative Industries and the Climate Crisis," highlighted the need for collaborative innovation in the sector if it is to adapt "to the inevitable changes already locked into climate impacts" (2022, 6). Creative Carbon Scotland[19] provides guidance for artists and cultural organisations and how they can take climate action. The Digital Humanities Climate Coalition[20] particularly tailors their advice towards researchers utilising digital methods, producing a toolkit to help make research practices more environmentally responsible (2023) and a "Research Guide to Writing a Climate Justice Oriented Data Management Plan" (DHCC, 2022).

Creative industries ethical approaches

There are a variety of unethical approaches that are all too familiar to those working in the creative industries, including plagiarism, copyright infringement, cultural appropriation, exploitative working practices, unfair compensation, data privacy violation, stereotyping and bias, planned obsolescence, and environmental negligence. The lack of regulation, pressure for innovation and creativity, and competition for attention and engagement, combined with a lack of education and training or ramifications can lead to poor individual and organisational choices and behaviours (Bouwer, 2019). The creative industries themselves are making various efforts to produce industry-specific (or even company-specific) codes of conduct, ethical guidelines, and education. For example, the Fair Wear Foundation[21] aims to improve labour conditions in the garment industry, and Black Lives in Music[22] have created a UK Music Industry Anti-Racism Code (2023) to protect and represent Black and ethnically diverse musicians and workers. However, there is, as yet no centralised effort to ensure ethical approaches to the use of data in the creative industries.

Given the scattered nature of the related advice (given previously), the complexity of understanding policy and legal frameworks, and the risk-averse nature of many ethical business policies, the potential benefits for the use of data in the creative industries are often lost, and innovative practices are often challenged. To mitigate against this requires development of a stream of practice-based thinking surrounding data ethics, which is not currently taught in many creative programmes and has only recently been more fully addressed as part of 'professional issues' components of computer science degrees, data skills programmes, and emerging data skills initiatives (e.g. under British Computer Society (BCS) guidance, graduates should have "the ability to recognise the legal, social, ethical issues involved in the exploitation of computer technology and be guided by the adoption of appropriate professional, ethical and legal practices" (BCS: The Chartered Institute for IT, April 2022)). However, these changes currently influence future/newly entering sector professionals rather than practising and trading creatives, and, as more formalised structures emerge (e.g., regulatory changes; more stringent or better publicised best practices), currently practising creatives will also have to step up their game; it's not just about training those early in their careers.

Prevention is the key route to addressing ethics within the realm of creative practice. This perspective must become deeply ingrained, given the intricate landscape of start-up investments and potential data reuse, sharing, or integration into future AI training datasets. Taking a proactive approach to ethics mitigates risks and ensures a safer and more effective pathway for new products, services, and experiences, but it also necessitates a fundamental redesign of digital tools and software to align with ethical data practices. A belated

rethink of architecture can lead to unwarranted delays and increased costs throughout the development process. A commitment to ethical data usage, coupled with a keen understanding of how design influences user perceptions of data utilisation and the overarching purpose of data use, holds the potential not only to conserve time and resources but also to guide start-ups or product development teams towards a more refined focus on key success metrics. This approach encourages a more profound understanding of their target audience, prompts strategic considerations for market positioning, facilitates the delineation of a robust product roadmap, and fosters the cultivation of trust and a positive brand reputation. Thus, while ethical data practices are indispensable from both a legal and ethical standpoint, a conscientious and introspective approach can significantly enhance the design and success of commercial creative products.

Themes in data ethics

There are a variety of themes that any project or initiative needs to address when considering the role of ethics in its approach to data, which remain true for its use within the creative industries. These include how data is collected, stored, and transmitted; consent and approval; privacy and how it relates to data aggregation; inclusive data design; ethical business and employment practices; data analytics, modelling, and their relation to inherent bias; and the environmental impact of digital activities. In addition, there then need to be put in place frameworks for managing responsibility when it comes to data, including accountability; responsibility for updating and checking ethical approaches; planned response to issues; codes of conduct; information security; risk registers and disaster recovery; responsibility for communications; and complaints processes, including whistleblowing.

From a practical point of view, there are various principles that can be put into place regarding the collection, storage, analysis, usage, and transmission of data. Informed consent is foundational, requiring clear communication with individuals about current and future data usage and the option to decline participation. Privacy, another paramount theme, intertwines with data aggregation, raising questions about the responsible handling of personal information within larger datasets. Anonymisation and robust security measures protect privacy and prevent breaches. Data minimisation emphasises collecting only necessary information, guarding against data sprawl. Embracing inclusive data design ensures that diverse perspectives and experiences are considered during data collection, promoting fairness and equity. Transparency is key, as projects should openly detail their data collection methods and potential risks. Responsible data retention and disposal, along with proactive bias mitigation, is critical. When it comes to data analytics and modelling, addressing inherent bias is imperative to avoid perpetuating unfair

or harmful outcomes. Compliance with data protection laws and stakeholder engagement, particularly those affected by data collection, are crucial. It is also important to understand that ethical practices are not restricted to newly collected personally identifiable data but also apply to work with existing modern and historical data sets which may be used in analytics, modelling, training data sets, and so on, which may carry their own bias and/or ethical questions. Last, recognising and mitigating the environmental impact of digital activities is increasingly vital as the digital realm's ecological footprint grows.

Accountability for data ethics plays a pivotal role in R&D, demanding that individuals and organisations alike take responsibility for their actions and that ethical approaches evolve in tandem with technological advances and societal changes. Planning responses to potential ethical issues is also vital, as it proactively addresses challenges that may arise via data handling. Many organisations are moving towards codes of conduct, which serve as guiding principles and set clear expectations, for governing data practices. Risk registers and disaster recovery plans become essential tools for pre-emptively identifying and mitigating potential risks to data ethics while establishing procedures for recovery and damage control in case of unforeseen crises. Responsibility for communications is an often overlooked but integral facet, emphasising transparent and ethical communication with stakeholders, including data subjects, to foster trust and understanding. An impactful example of this type of meaningful stakeholder (and data subject) engagement and accountability can be found in the work of Design Beku in creating the AI (ADMS) observatory, which documents both actual and potential harms to individual and collective rights, building upon a long-standing programme of ethical co-design work with grassroots communities from their base in Bengaluru, India.[23] (Engagement and awareness of stakeholders in data projects is also explored further in this chapter's case study on Kate Steenhauer's work.) Last, an effective complaints process, which encompasses mechanisms for addressing potential harms and for effective whistleblowing, stands as a cornerstone of ethical data governance, offering a channel through which individuals can voice concerns and expose unethical practices without fear of retaliation, thereby reinforcing the accountability framework. (For overview texts that consider these aspects, see Brown, 2013; Mallery, 2015; Richterich, 2018; Room, 2021; Ajunwa, 2023.)

The interconnectedness of all of these themes underscores the complexity of data ethics in contemporary R&D projects, particularly for those working – like much of the creative sector – as freelancers or in micro-SMEs. It is clear that a structured approach to contemplating ethical approaches to the use of data in the creative industries is beneficial to those undertaking innovation in this space rather than hoping that every project would be able to tackle every facet of a rapidly changing topic in a technologically fluid space.

Creative Informatics' self-assessment approach

Over its five-year funded period (2018–2023), the Edinburgh based Creative Industries Cluster (see Chapter 2) Creative Informatics funded over 130 small R&D projects. As part of our approach to managing funding, each funded project had to undertake an audit of their approach to innovating with data, using our "Creative Informatics Self-Assessment Ethics Review Form" (Osborne et al., 2020, and see Appendix 1). This provides a structured way of thinking through project values and priorities and encourages thoughtful reflection on work with data and new technologies in the creative industries. Given that this was a prerequisite to unlocking funding, and part of each project's contracted duties, we did not experience any significant resistance to this approach, although participants found the process unusual, often finding themselves thinking in these broad ethical terms for the first time, and sometimes struggled to find time to engage significantly or prioritise this. However, once initially completed, the forms allowed a constructive to-and-fro between Creative Informatics and each project, encouraging and supporting while also highlighting particular ethical aspects that are of importance to the creative industries.

Creative Informatics participants that benefited from this consultation included Bearhammer Games,[24] a company developing Venture's Gauntlet,[25] a VR adventure fitness game. As a game with user profiles, there is an element of using data on users, as well as necessary performance tracking to enable gameplay; as a VR game they are dependent on third-party hardware and their users accessing and experiencing their game within the context of this hardware and their associated distribution platforms, and as a health and fitness game there are elements around handling of health and performance data to consider. One of the challenges of complex data-driven projects like this is their use and dependencies on other tools, systems, and platforms, which adds complexity to legal, user experience, and data use expectations and broader ethical considerations. Bearhammer made productive use of the ethics process and extended follow up discussions to reflect on their offer, how they articulate use of data, and how their own software and game experience relates to other software and hardware tools it integrates with – and associated terms of use across platforms and third-party tools. This example illustrates that whilst ethics processes can seem quite theoretical, applying them to practical creative practices and businesses requires engagement with technical detail, information security processes, as well as underpinning business models and long-term plans that may be significant for articulating planned current and future use of data – whether personal data (subject to data protection), licensed data (e.g. through partners or data suppliers), or new data created or generated as new intellectual property for the creative organisation.

For artist Andrew Brooks,[26] developing his award-winning FND Stories[27] art project, the issue of ethics was always core to his artistic process, which sat at the intersection between qualitative research and artistic practice. Brooks

was creating art works from data on the experience of living with functional neurological disorders (FND)[28] and worked with the charity FND Hope[29] to identify interviewees. In discussing the ethics around this project, there needed to be consideration of building appropriate transparency and trust with participants around how their lived experiences would be communicated in the art, what kinds of advance consent would be needed depending on how the resultant art works would be used, and how the ethics of this project related to wider best practices and processes already in use by FND Hope. The data to be collected was highly personal and emotive in nature, and, whilst some data was collected through a (global) survey, a significant element of the data collection was an in-depth interview process with a small number of participants who would inevitably be somewhat identifiable, with elements of transcribed text and non-anonymised video content directly forming parts of the artworks. Discussing some of these issues at the outset enabled Brooks to find the right balance of information and consent and to think about his longer-term plans for the works and their use. One particular point of discussion was looking forward to potential future exhibition plans and any potential for sale of the works and what implications this would hold for participants and the type of consent required. Given the potentially exposing experience of being part of an art project of this type, these discussions with both Creative Informatics and FND Hope, as well as Brooks' own reflection on the experience he wanted to create for his participants, were important to consider and establish prior to gaining initial consent. As has often occurred across discussions with Creative Informatics projects, discussions of ethics considerations inevitably also touched upon future plans, business models, and the wider values of the R&D project team as they looked towards the kinds of business or experience they want to create. Through his project, Brooks was able to build a strong and trusted relationship with his participants, leading to a very warm reception from both his participants and wider audiences to his initial exhibition of FND Stories at Inspace gallery[30] in June 2022, with the work going on to win the Art of Neuroscience Award 2023.[31]

Over the course of the Creative Informatics programme, and through discussions with many projects, we have observed a number of trends. These include a shift over time toward deeper engagement with both environmental and information security concerns, in line with wider public discourse. There has often been a lack of understanding of what is and what is not personal data and where particular data may still carry risks around identifiability or profiling. There was a lack of understanding of the reusability of data beyond its created bounds, particularly regarding third-party interactions about data and the implications this may have. There was also confusion regarding data retention and what is or is not appropriate under the consent obtained at the outset of a project.

In the context of a project such as CI, the use of an ethics framework can be clearly bounded by funder requirements and reporting mechanisms. For

those operating without such constraints, it can be difficult to inculcate ethical approaches, as the perceived risks can be deemed low, while the effort needed to understand and mitigate for ethical issues is high.

It became clear to us that while our form provides a structured mechanism for self-reflection, the interaction with the Creative Informatics team to discuss and lodge the forms was an equally crucial part of the process, providing a mechanism for improvement but also accountability. Without this, the self-reflection activities may not have enough strength to stand alone (this is a well-understood aspect of self-reflection and systems that depend on self-starting, see Fetterman et al., 1996). It is also worth noting that most of our projects were short-term (3–12 months), but ideally this ethics review process would be repeated every 6 months or so (data-based projects tend to develop and morph rapidly). Regularly providing this mechanism for discussion and accountability is therefore resource intensive. Self-assessment itself may also be the mainstay of a rich, white western institution with generous funding, and further consideration is needed as to how this approach intersects with diversity and global issues and whether it is appropriate or applicable to all cultures and resources. For example, publicly funded organisations often have to make choices regarding data collection and analysis versus risk mitigation of the use and storage of that data: the time and effort needed to undertake data self-assessment is not inconsequential and may itself have ramifications.

Recommendations

Following on from our experiences within the Creative Informatics programme, we recommend the following concrete approaches to engaging with ethical aspects of data within the creative industries. First, we recommend the adoption of best practices – although those practices are constantly changing. Sources of emerging best practice are given previously, and we encourage practitioners and funders to watch this developing area. Second, we encourage the embedding of ethical aspects of creative work within schools, higher, and further education frameworks, as well as the need to provide mechanisms for upskilling for existing practitioners. We encourage those providing online resources in this area, including self-assessment tools, to keep an eye to inclusion and diversity, particularly in order to enable creatives to engage without feeling excluded by technical (legal and technological) language. All training materials need to emphasise the benefits of a data ethics approach, giving concrete frameworks and examples on how to adopt data ethics best practices and placing less emphasis only on risk management and potential issues, which can lead to creatives moving away from productive and appropriate use of data, or failing to get consent for potentially beneficial uses of data.

We encourage accountability for data ethics approaches, and this comes with the need to provide structured methods and approaches above and beyond existing legal frameworks of interventions for clear misconduct. For example, funders and research support organisations are well placed to establish checks, balances, and reporting structures, given those that they fund are inherently motivated to engage with funder requirements. Likewise, the inclusion of ethics in contracts is essential: Creative Informatics found that including ethics reporting as a required component in contract processes led to fruitful and productive self-reflection, requests for support, and opportunities for discussion which enabled wider reflection on the role of data in emerging products while also introducing accountability to the process. Finally, we welcome further opportunities for critical intersectional engagement in data ethics conduct – particularly in awareness of the important interconnectedness of the availability of digital data sets to the shaping and training of AI. The inequalities that are often embedded in new AI models and systems as a result of utilising data that is not appropriately reflective or representative of society have the potential to cause great and ongoing societal harm, and whilst these are issues for all modern data providers, they are also increasingly important for SMEs as AI enters more widespread adoption at all levels of the creative industries.

Conclusion

There is clear demand and interest in the appropriate and ethical use of data within the creative industries – though this is not universal. There is also a clear need for both structured guidance and for support navigating and understanding already-available guidance. Whilst there is a strong array of guidance and best practice documents, approaching these can be intimidating and sometimes require support and scaffolding to help creatives understand which elements are relevant and to see ahead to potential future risks.

Embedding ethics into the work of creative SMEs is non-trivial and still unusual but does position them for future robustness in terms of facing potential risks; building trust with users, customers, and investors; and ensuring they are better skilled to face the ethical complexity of working with data as a key business asset and tool for building new and disruptive business models. The Creative Informatics framework we have provided in this chapter provides a mechanism by which to explore ethical aspects of innovation, but we also stress the need for accountability and the importance of mechanisms which will hold creatives to account (whether from a funder or consumer perspective). Only by placing data ethics at the heart of data innovation in the creative industries can we build new products, services, and experiences that cause minimal harm while encouraging inclusion, sustainability, and long-term success. Ethics must become embedded into all aspects of creative data practice.

APPENDIX 1

Creative Informatics self-assessment ethics review form

Here (in Table 6.1) we introduce our framework (Osborne et al., 2020), which provides a level of guidance for those working in and around the creative industries or with data more broadly in a creative context. It should be used as a tool for reflection with prompts to consider, document, and review approaches and practices and as a way to encourage positive engagement with legal and societal responsibilities. While these questions cannot be exhaustive, they should prompt review and reflection upon creative activities, asking how any entity will ensure their product, service, or business activities are consistent with emergent ethical best practices. We recommend that this be thought of as a living document, which is regularly revisited, particularly in conversation with an authority that can encourage accountability.

TABLE 6.1 Creative Informatics Self-Reflection Ethics Checklist Form

Ethical Consideration		*Please explain your answers to the list of ethical considerations (e.g. your approach, processes, etc.) and any actions that may still be required.*
Existing Data: Any data I/we are using has been collected in fair and appropriate ways and is licensed/approved for the way we are using it.	☐	

Ethical Consideration		*Please explain your answers to the list of ethical considerations (e.g. your approach, processes, etc.) and any actions that may still be required.*
Collecting New Data:		
My/our practices comply with key legislation (GDPR, Data Protection, Privacy and Electronic Communications Regulation) and/or we are taking action to ensure compliance.	☐	
I/we have considered if we need specialist legal advice on the data we are collecting.	☐	
I/we have undertaken privacy impact assessments (PIAs).	☐	
I/we have considered the data we collect or plan to collect and ensured that:		
– The use, aggregation, and processing of any personal data is fair and appropriate.	☐	
– There is a valid and legal basis for processing any personal data (consent or other legal basis).	☐	
– Any data is used for a defined purpose and there are processes to monitor any change in purpose.	☐	
– Users understand, through clear communication, how their data is being collected, how it is used now and may be used in the future, how their data is stored, who will have access to it, and how they can make changes or withdraw consent in the future.	☐	
– Risks are minimised for more vulnerable users (which may include not capturing their data, clearer or alternative communications, easy withdrawal of consent).	☐	
– Long-term privacy implications have been considered, including processes for managing requests by users to change or withdraw consent for use of their data.	☐	

(*Continued*)

TABLE 6.1 (Continued)

Ethical Consideration		*Please explain your answers to the list of ethical considerations (e.g. your approach, processes, etc.) and any actions that may still be required.*
I/we have considered our responsibilities towards users around any data that is or could be/become personally identifiable (e.g. location, biometric data, user behaviour data, etc.) and long-term privacy implications arising from the data or of this data being used in combination with other data sets.	☐	
Storing Data:		
I/we know where any data we collect and use is stored or processed, and this is compliant with legislation and user privacy rights (e.g. in the UK or EU) as well as user expectation.	☐	
Access to any data is restricted to authorised individuals who truly have need to access it.	☐	
Data is safe from unauthorised insiders or external attackers and there are processes to respond if it is compromised.	☐	
Data is stored in the safest form through anonymisation, encryption, etc.	☐	
Inclusive Design:		
Our product/service/business is:		
– Compliant with equality and human rights legal requirements.	☐	
– Designed to be inclusive of all users.	☐	
– Accessible to those with disabilities.	☐	
– Respectful of diverse populations and cultural backgrounds.	☐	

Ethical Consideration		*Please explain your answers to the list of ethical considerations (e.g. your approach, processes, etc.) and any actions that may still be required.*
Ethical Business and Employment Practices:		
My/our business model and/or production methods respect others' rights.	☐	
My/our workers and subcontractors are paid appropriately for the minimum or living wage in their locality, their human rights are respected, and they are working under fair contract terms.	☐	
My/our product/service/business is not reliant on exploiting volunteered, underpaid, or 'gig economy' workers.	☐	
Data Analytics and Modelling:		
Any text and data mining, machine learning, or AI used with data in my/our product/service/business:		
– Are based on training data sets representative of wider and diverse society.	☐	
– Are not unfair, exclusionary, or discriminatory.	☐	
– Do not reinforce or create new inequalities.	☐	
I/we are committed to monitoring the fairness and appropriateness of our data analytics and modelling approaches to ensure they remain ethical.	☐	

(*Continued*)

TABLE 6.1 (Continued)

Ethical Consideration		*Please explain your answers to the list of ethical considerations (e.g. your approach, processes, etc.) and any actions that may still be required.*
Environmental Impact:		
I/we have considered the environmental impact of our chosen technologies and reviewed less environmentally impactful alternatives.	☐	
I/we have reviewed or are in the process of reviewing the future environmental impact of any goods or physical materials that will be created and how this may be minimised (e.g. through measures to ensure they can be recycled).	☐	
I/we are committed to reviewing the environmental impact of our product/service/business and, where possible, documenting and tracking this.	☐	
Ongoing Review:		
I/we are committed to reviewing this ethics self-assessment on a six-monthly basis, and this is embedded in my/our organisational processes.	☐	The named person responsible for this review is: The next review is due to take place on:
Additional comments, concerns or notes:		
Are there any ethical areas where you need further advice or support?		
By signing below you are indicating that: *I have read the Creative Informatics Ethics Statement, considered how it applies to my own organisation or practice, and completed the self-assessment checklist for my product, service, or business.* **Name:** _____ **Date:**		

APPENDIX 2

Ethics guidance and resources for data, data science, and AI

TABLE 6.2 Suggested Guidance and Resources

Resource	*Publication Date*	*Further Information*
Beijing AI Principles (documented in Datenschutz und Datensicherheit – DuD, 43)	2019	https://doi.org/10.1007/s11623-019-1183-6
The CBI (Confederation of British Industry): Embed, Engage, Explain – A Guide to Approaching Data Ethics	2022	https://www.cbi.org.uk/articles/embed-engage-explain-a-guide-to-approaching-data-ethics/
Centre for Data Ethics and Innovation (CDEI), part of the Department for Science, Innovation and Technology	2022 onwards	https://www.gov.uk/government/organisations/centre-for-data-ethics-and-innovation
Data Feminism – D'Ignazio, C. and Klein, L. F. (MIT Press)	2023 (first published 2020)	https://direct.mit.edu/books/oa-monograph/4660/Data-Feminism
Digital Catapult Machine Intelligence Garage: Ethics Framework	2021	https://futurescope.digicatapult.org.uk/wp-content/uploads/2023/04/DC_AI_Ethics_Framework-2021.pdf
IEEE Ethically Aligned Design	2018	https://standards.ieee.org/wp-content/uploads/import/documents/other/ead_v2.pdf

(*Continued*)

TABLE 6.2 (Continued)

Resource	*Publication Date*	*Further Information*
Information Commissioner's Office (ICO): Advice for Small Organisations	2016 onwards	https://ico.org.uk/for-organisations/advice-for-small-organisations/
Information Commissioner's Office (ICO): Guidance on AI and Data Protection	2023	https://ico.org.uk/for-organisations/uk-gdpr-guidance-and-resources/artificial-intelligence/guidance-on-ai-and-data-protection/
Microsoft Research Group FATE: fairness, Accountability, and Ethics in AI	2018 onwards	https://www.microsoft.com/en-us/research/theme/fate/
The ODI (Open Data Institute) Data Ethics Canvas	2021	https://www.theodi.org/article/the-data-ethics-canvas-2021/
OECD AI Principles	2019	https://oecd.ai/en/ai-principles
Omidvar Network Ethics Explorer Tool	2020	https://ethicalexplorer.org/
A People's Guide to AI	2018	https://mimionuoha.com/a-peoples-guide-to-ai
UK Government Data Ethics Framework	2018 onwards	https://www.gov.uk/government/publications/data-ethics-framework
UN Guide to Business and Human Rights	2011	https://www.business-humanrights.org/en/big-issues/un-guiding-principles-on-business-human-rights/
Unbias Awareness Cards	2018	https://unbias.wp.horizon.ac.uk/fairness-toolkit/
World Bank Code of Ethics	2020 (published 2022)	http://documents.worldbank.org/curated/en/147281468337279671/WBG-Code-of-Ethics
World Federation of Advertisers: Data Ethics – The Rise of Morality in Tech; The CMO Guide to Data Ethics in Practice; Data Ethics Playbook	2020 onwards	https://wfanet.org/leadership/data-ethics

Notes

1 The Guardian 2018, The Cambridge Analytica Files. https://www.theguardian.com/news/series/cambridge-analytica-files
2 https://www.gov.uk/government/organisations/centre-for-data-ethics-and-innovation
3 https://ico.org.uk/
4 https://www.legislation.gov.uk/ukpga/2010/15/contents
5 https://www.gov.uk/data-protection
6 https://www.legislation.gov.uk/uksi/2019/605
7 https://bills.parliament.uk/bills/3137
8 See https://gdpr-info.eu/ and https://gdpr.eu
9 https://theferret.scot/
10 https://edinburghtoollibrary.org.uk/
11 https://myturn.com/
12 Estimates quoted in ETL Adopt-a-Tool campaign: https://edinburghtoollibrary.org.uk/adopt-a-tool/
13 https://aoir.org
14 https://www.oecd.org
15 https://www.digicatapult.org.uk
16 https://futurescope.digicatapult.org.uk/our-programmes/machine-intelligence-garage/
17 https://direct.mit.edu/books/oa-monograph/4660/Data-Feminism
18 https://juliesbicycle.com
19 https://www.creativecarbonscotland.com
20 https://sas-dhrh.github.io/dhcc-toolkit/
21 https://www.fairwear.org/
22 https://blim.org.uk
23 https://ai-observatory.in/
24 https://bearhammergames.com/
25 https://store.steampowered.com/app/1840140/Ventures_Gauntlet_VR/
26 https://www.ajb-art.com/
27 https://www.ajb-art.com/fnd-stories
28 https://www.nhsinform.scot/illnesses-and-conditions/brain-nerves-and-spinal-cord/functional-neurological-disorder/
29 https://fndhope.org/
30 https://inspace.ed.ac.uk/exhibition-fnd-stories/
31 https://web.archive.org/web/20230917083142/https://aon.nin.nl/

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CASE STUDY

Creating music from art: Kate Steenhauer and painting with music

Kate Steenhauer is a visual artist and filmmaker, whose practice explores the dynamic and interactive nature of painting in dialogue with other artforms, technology, and their relationship with audiences. Her multi-award-winning cross-disciplinary collaborations encompass live stage performances directed by Aberdeen Performing Arts and National Theatre of Scotland, audio-visual productions consisting of films and (live) installations, and group and solo art shows exhibited across the UK.

In 2020, Kate applied to be a Creative Informatics Connected Innovator to progress work on her project, Painting Music.[1] Developed in collaboration with AI developers Andrew Starkey and Jack Craven from Aberdeen University, Painting Music uses artificial intelligence (AI) to create music from live painted drawings. The AI algorithm is based on neural nets and exploits areas of similarity within the two distinct artforms to respond to the live-painted elements, producing musical notes that reflect the development of the evolving artwork.

Following the demonstration of a prototype system[2] at Aberdeen May Festival 2019, Kate was keen to expand her vision – building on this prototype and bringing Painting Music to creative communities and audiences, encouraging them to investigate and explore the realm of AI and its impact on our world.

During her Connective Innovator attachment, she therefore determined to develop a standalone version of the system that does not require input from the AI team and can be controlled by the artist, which was a particularly pertinent need during the COVID-19 restrictions in which this activity was taking place. To achieve this, Kate used the Creative Informatics funding to enable the procurement and development of hardware and software in collaboration with fellow creatives and technical specialists across a diverse range of expertise, including fellow Creative Informatics partners Ray Interactive, who provided the system's functionality, including hardware, software, construction, and labour.

The bespoke 'toolkit' produced comprised two cameras (one to monitor the painting, the other to alternate between capturing close-ups of the act-of-making and the artist themselves), painting board, lighting, laptop, and software, which allowed Kate to independently generate high-quality material through digital as well as physical platforms not only in relation to Painting Music but exploitable for any of her other collaborations (Pingel, 2021).

This system was subsequently used in a live setup for a production called *In the Bell*, engaging the Scottish Trans community, with Kate additionally securing a contract to give a series of six online workshops with the Painting Music system at An Lanntair Education and Outreach programme working with

young people in the Outer Hebrides, as well as a series of public workshops in collaboration with the Elphinstone Institute (which researches and promotes the culture of the north and northeast of Scotland) and a local Aberdeen community centre.

With her Connected Innovators work successfully concluded – and having developed a comprehensive set of creative and technical skills in programming and AI through work with project partners – Kate went on to become part of the final Resident Entrepreneurs cohort in 2022, seeking to create an audience interactive Painting Music product. This portable standalone system would allow the general public to create music in real time (either in conjunction with Kate or without), using AI by painting on their own mobile phone or via a single iPad. This mini performance, created by the public, could additionally be broadcast on a screen as an audio-visual installation or shared via social media platforms.

With work still ongoing, Kate and her collaborators have completed a prototype of the Painting Music Sketchpad, an application that converts arbitrary shapes into credible and consistent music in a contemporary classical/minimalist style. Though the current prototype does not currently employ an AI/ML model, instead using a set of hard-coded rules that use these categories to decide what music to produce, which limits the potential variation of the musical output, further development into integrating AI into the setup has been supported by Creative Informatics' Creative AI Music & Audio Pilot Project – in 2023.

This additional funding significantly enhanced and optimised the music generation to produce an AI-driven system that is capable of creativity during the composition process, using recent advances in AI at the University of Aberdeen that will allow the AI to choose notes to play based on learning derived from previous musical pieces. The difference to other approaches will be the ability of the system to understand what combinations of notes have *not* been played together, thereby giving a framework that will allow the AI to creatively investigate unexplored spaces in its network (i.e. combinations of notes not previously played in its experience). This new version will produce more sophisticated and interesting outputs which should drive a greater user experience of the Sketchpad and Canvas Capture.

The unique selling point of Painting Music is that it uses AI models that are explainable – an approach that also allows for more transparent and less environmentally impactful use of AI. A lot of AI models being used in industry are 'black box' AI which use very large data sets and do not enable users to understand how and why the AI model has made its decisions. This is not the case with the model being developed for Painting Music, where the use of explainable AI means that decisions can be better interpreted and understood and exemplify the product's fundamental commitment to raising questions and stimulating conversation around AI ethics, the datasets used for training AI

models, the role of explainable vs black-box AI approaches, the application of AI itself in our world, and the subsequent impact it has on our society.

To complement the project, the team behind Painting Music has made a short award-winning documentary about that performance and the software. This film has been shown at multiple events such as 2021 Synaesthesia Ars Electronica, 2021 Visual Arts Scotland exhibition, 2020 George Washington Wilson Centre for Art and Visual Culture, and Haddo House 2019 Arts Festival, where it received praise from King Charles III.

Victoria Murray

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Prototype demo videos

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https://youtu.be/ZxJBW-1IAK0
https://youtu.be/R9IF2CtQnds
https://youtu.be/c_1zhAZa4gI

Case study notes

1 https://katesteenhauer.com/painting-music/
2 See https://vimeo.com/601714128/fc4e5f003f

7

OWNERSHIP AND CONTROL IN THE CREATIVE ECONOMY

On new property rights for digital assets

Melissa Terras, Burkhard Schafer, and Amélie Favreau

Abstract

This chapter explores the evolving legal context surrounding the ownership of digital assets, delving into the ramifications of legal frameworks such as property law, copyright, and data protection for the creative digital industry. We underline the importance of the nexus between ownership technology and legal reform, which will bear profound implications for the digital creative economy. Focusing on the recent consultation and recommendations by the Law Commission of England and Wales on this topic (2022–3), we suggest incremental legal adjustments as alternative strategies. We juxtapose this backdrop with a case study on non-fungible tokens (NFTs), which are envisioned as a "property layer" in the emerging Web3 Internet. The ascent of NFTs, evidenced by eye-catching transactions in the art world, underscores a paradigm shift in digital ownership. However, NFTs and decentralised technologies, while holding substantial promise, do not yet fully align with creatives' desired rights. In order to provide legal certainty, we emphasise the need for nuanced understanding and collaboration among legal scholars, computer scientists, and creative industry stakeholders in order to reimagine property rights in the digital sphere, shaping the future of digital assets and their place within the creative economy together.

Introduction: ownership and the evolving landscape of digital assets

The pervasive influence of the internet and digital technologies has introduced a profound disruption to established notions of ownership, control, and copyright within the creative industries. The unprecedented ease of

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replicating and disseminating digital content challenges the traditional models of intellectual property protection. This disruption extends to the very core of artistic ownership, as the digital realm offers new avenues for creative expression, collaboration, and distribution of both content and data (see also accompanying case study). However, this paradigm shift also brings forth challenges and dangers. The democratisation of content creation and distribution can dilute creative control, as works are susceptible to unauthorised reproduction and modification. Moreover, the fluidity of digital platforms sometimes blunts copyright enforcement, allowing for the rapid proliferation of unattributed or misappropriated works.

As a result, practitioners within the creative industries find themselves navigating a landscape that demands innovative approaches to safeguarding their intellectual property rights while concurrently embracing the transformative potential of digital technologies. In this context, preserving the integrity of creative works and ensuring equitable compensation for creators emerge as critical imperatives for the sustainability and vitality of the creative ecosystem. However, reforming the law of digital assets has implications on the future dynamics of the creative digital industry. This chapter seeks to contextualise this discussion and explores the implications of different legal frameworks, such as property law, copyright, and data protection in a distributed economy. In order to do so, it takes as a case study the broader discourse surrounding the legal status of non-fungible tokens (NFTs).

To fully appreciate the significance of changing legal frameworks about ownership and control, it is imperative to delve into the historical evolution of property law. In 2016, Perzanowski and Schultz (2016) declared a notable shift with "The End of Ownership," attributing the marginalisation of ownership within the economy to the advent of the internet and digitalisation. This transformation has led to the prominence of intellectual property law, data protection regulations, and contractual agreements, albeit at a substantial cost to consumers, data subjects, and particularly artists and creatives. As an alternative, NFTs and related decentralised technologies have been proposed for a new "property layer" within the future internet (McConaghy and Holtzman, 2015), often referred to as Web3 (Voshmgir, 2020). This layer aims to restore the original promises of decentralisation and disintermediation while mitigating the adverse impact of rampant digital replication on creatives' business models.

Given the emergent rise in the use of decentralised technologies, in 2022, the Law Commission of England and Wales started an ambitious law reform project on the property status of digital assets (2022). Central to the proposal of the Law Commission is to create an entirely new type of property class: ownership of digital assets. To do this, it suggests replacing the concept of possession – the way in which we can exercise our rights over physical objects such as pens, by simply holding them – with a concept of "control."

For example, a person who mints an NFT can exercise control over it, so it closely resembles the way we possess ordinary physical goods, so that an analogous legal treatment is merited.

Responding to the consultation, Creative Informatics[1] organised, together with DECaDE, the Centre for the Decentralised Digital Economy,[2] a series of engagement workshops in October 2022 that informed a submission to the consultation (Schafer, 2022). We use this context as the basis upon which to discuss the changing nature of ownership within the digital economy. While NFTs play a central role in the proposal of the Commission, the questions it raise go far beyond that specific technology potentially heralding a sea-change in the way in which the digital economy in general, and the creative digital economy in particular, will operate.

While the potential advantages of NFTs and related decentralised technologies are noteworthy, this chapter contends that they are in their present form unlikely to provide the desired rights and aspirations of creatives and their patrons. The Law Commission's 2022 proposal and 2023 recommendations, while commendable, may require further development to effectively address underlying concerns. The current approach appears excessively focused on a particular technology and its development, potentially hindering the law's ability to adapt to future changes. In addition, it excessively favours a technology characterised by significant shortcomings and high environmental costs. Instead, incremental legal adjustments, such as updating technical aspects of copyright law and implementing stricter regulations concerning the rights associated with purchasing NFTs, could provide a more efficient solution to specific legal challenges. Nevertheless, the proposal underscores the prospective synergy between ownership technology and legal reforms, with far-reaching implications for creatives and the broader digital economy. This dynamic presents intriguing design challenges for both computer scientists, platform providers, and the creative digital sector and will require that creatives understand the changing regulatory and technological environment in order to protect their, and utilise others', digital assets.

Digital assets

The term "Digital asset" is broad and rather all encompassing:

> It captures a huge variety of things including digital files, digital records, email accounts, domain names, in-game digital assets, digital carbon credits, crypto-tokens and non-fungible tokens. The technology used to create or manifest those digital assets is not the same for each. Nor are the characteristics or features of those digital assets.
>
> *(Law Commission, 2023, p. 2)*

The range of resources, many of which are in emergent formats, described by this indicates how crucial they are to our functioning economy:

> Digital assets are increasingly important in modern society. They are used for an expanding variety of purposes – including as valuable things in themselves, as a means of payment, or to represent or be linked to other things or rights – and in growing volumes.
>
> *(Law Commission, 2022, p. 1)*

However, the electronic nature of born-digital and digitised assets creates particular challenges. It makes them considerably more vulnerable than other types of assets (see Deegan and Tanner, 2006 for the complexities of digital preservation. The Library of Congress attempt to provide guidelines on the preservation of various different creative formats, "maximizing the chances for survival and continued accessibility of creative content well into the future" (2023)). This can be exacerbated in the creative industries, with many small businesses operating without access to institutional back-up processes, infrastructure, or support (Keller et al., 2005).

In addition to these digital preservation challenges, more malleable nature of control over digital assets also creates opportunities that remain currently under-explored in creative or legal frameworks:

> this could facilitate more distributed and equitable access to property rights and to the legal recognition and protection they provide, allowing a more diverse range of people, groups and companies to interact online and to benefit more widely from their own productivity. Digital assets themselves enhance this process by enabling the communication of value via electronic means, which broadens the scope of and access to markets and increases the transferability, composability and liquidity of things of value.
>
> *(Law Commission, 2022, p. 2)*

A wider discussion of the current legal frameworks which underpin the digital economy can contextualise their limitations and the opportunities for change in identifying "digital asset" as a specific property class. In particular, it is necessary to focus on the perceived end of ownership in today's successful digital economy and the ramifications this has for the creative industries.

The end of property?

In 2016, Perzanowski and Schultz (2016) showed how notions of ownership have shifted in the digital marketplace, declaring the increased use of licenses to access digital content "The End of Ownership" while making an

argument for the benefits of personal property, particularly around user constraints, permanence, and privacy. This had continued to play out online: nowadays, the internet is dominated by major platforms and technology providers that utilise surveillance capitalism (Zuboff, 2019) as their profitable business model. Yet few major platforms (such as Meta/Facebook, Twitter, YouTube), *own* their two most valuable assets – the *digital content* that the platform users generate and that drives the interest in and interaction with their profit-making platform and the *personal data* that these interactions generate. However, they have also managed to shield themselves from some of the consequences that one might otherwise have expected from such a lack of legal title. Rather, platforms have acquired a (temporary and revokable) permission to use both content and data from (possibly, ideally) the owner for the digital content and, for personal data, from the data subjects themselves. Often, this takes the form of standard contracts together with the platform's terms and conditions, leveraging the network effect that underpins their bargaining strength – agree or risk losing your audience, as your friends (and customers) are already with us (Barwise and Watkins, 2018). Contract, rather than property, then becomes the dominant legal paradigm to order relations online.

This has significant social consequences. Property law gives an "absolute" title – if you own a (physical) painting, nobody is allowed to take it away from you (Singer, 2022). Contract law by contrast only gives a relational right (Stone and Devenney, 2022) – if you permit anyone to borrow this painting, this only gives a right to them, and nobody else. The stronger title that property law confers comes at the cost of "rigidity": the law prescribes exactly what rights adhere to an owned thing, and these and only these rights are transferred if someone else acquires the object. This allows the state to shape property in a way that meets its (democratically legitimated) vision of the common good. If someone acquires your painting, they acquire a bundle of specific rights, defined in law (such as the right to sell the painting in turn) and nothing else. Contract, by contrast, allows the two parties to agree on any condition they like – the contract is "private" between them and hence, within reason, nobody's business.

Through contracts, two parties can create and shape the legal relation between them. This is unproblematic if they both have roughly equal bargaining power and really consent freely in the contract. However, internet service providers and large platforms in particular have considerable bargaining power – and offer their services on a "take it or leave it" basis – with no scope for an individual to negotiate their own contract with the likes of Facebook or YouTube. The law began to recognise this problem at the end of the 19th century and used the concept of "good faith" to put limits on what the stronger party can induce the weaker to agree to (Gilmore, 1953). Nowadays, this finds its main expression in consumer protection law (Howells and Weatherill, 2017). But, as the name suggests, consumer protection

law protects only consumers and for this reason alone is of limited usefulness in the world of Web 2.0 and the "prosumer" who is both consumer and producer/seller of goods. Therefore, although the internet came with the promise of disintermediation, for example, connecting a creative directly with a customer, patron, or audience, we instead created a world where both rely on powerful digital intermediaries like YouTube or Spotify. Contract law provides next to no protection for the creative who needs the platform to reach any audience, as the law treats them for contract law purposes as the platform's equal; subscribers of the services are only marginally better protected.

The end of property in the creative economy?

While large platforms managed to operate even in the absence of property titles to digital assets, the repercussions are even more noticeable, and less easy to circumvent, for individuals who participate in the digital economy, be it as content creators or data subjects. Over the last three decades, when property law went into retreat from the digital domain, other legal disciplines were "commandeered" to fill the void, most importantly copyright and data protection law. Neither, however, was designed for this role. This has often resulted in their overreach, using their underlying normative logic and value systems for issues they are ill suited for (Depoorter, 2008). Conversely, the perceived need to shoehorn problems into either system has also negatively impacted their performance for those fields they were designed for. The common misconception of personal data as something owned by the data subject in particular is harmful for an adequate privacy protection regime.

Creators and the creative industries have found themselves more often than not at the centre of the ensuing realignment, including the legal debates and the struggle to retain control of assets (and revenue flow) online. The digital landscape, while offering unprecedented avenues for exposure and distribution, has simultaneously facilitated the unauthorised duplication and dissemination of creative works. The ease of copying and sharing digital content has led to rampant piracy and uncontrolled replication, eroding the creators' ability to regulate and monetise their creations (Handke et al., 2016). Additionally, the proliferation of user-generated platforms and social media has enabled the uncredited use and resharing of copyrighted material, further undermining creators' control over their intellectual property (Lessig, 2009). The evolving business models in the digital space, often centred around free or low-cost access, have complicated the process of generating sustainable revenue for creators (Li, 2020). This shift challenges established monetisation strategies, as the traditional revenue streams from physical sales or licensing have been disrupted. Furthermore, the complexity of digital platforms and the global nature of the internet make it difficult to enforce copyright and intellectual property rights consistently across different jurisdictions (De Beer

and Clemmer, 2008). As a result, creators often find themselves engaged in a constant struggle to identify, track, and address instances of unauthorised use or infringement and are often at a loss as to how to engage with emergent, decentralised technologies, despite the fact they hold the potential for efficient transactions, greater accountability, and increased or direct payment (Patrickson, 2021).

It was not meant to happen like this. The internet, born with the promise of disintermediation and decentralisation, quickly reverted to an economy that, if anything, became more centralised, with choke points that either were re-reincarnations of old intermediaries online (such as Disney), new players fulfilling similar purposes (such as YouTube, Amazon, or Facebook), or architectural service providers such as Google that enable the former to function (Wigand, 2020). Early on, when the law seemed to be in retreat, digital rights management (DRM) technologies were used, but they systematically over-enforced copyright, to the detriment of legitimate sharing, using, criticising, or commenting on work. DRM strengthened the power of platforms while disrupting community building between creatives and their customers (Erickson, 2003). Nowadays, anti-competition law that fines or breaks up online monopolies has become the most important regulatory tool for the internet (Volmar and Helmdach, 2018).

A few creatives have managed, and manage, to use the decentralised internet architecture to its greatest effect, connecting more directly with their fans and finding in the process new ways to monetise their skills (see Chapter 8). Over the last few years, blockchain technology has increasingly been promoted as a possible answer, rekindling the vision for a future "Web3" that this time round will be, and remain, more truly decentralised that Web 2.0 was able to (Voshmgir, 2020). However, these technologies require further developments regarding their legal standing to provide certainty in this rapidly evolving space.

The ascendance of non-fungible tokens: a paradigm shift

Starting around 2017 and gaining momentum during the COVID-19 pandemic, the term "non-fungible token" went from obscurity to prominence. Striking headlines such as "Grimes Sells $6 Million Worth of Digital Art as NFTs" (Kastrenakes, 2021) and "Beeple NFT Fetches Unprecedented $69.3 M. at Christie's" (Villa, 2021) underscored the perception of unexplored wealth and fresh revenue streams for digital artists. These instances seemed to mirror the economic transactions that were the hallmark of the traditional, tangible world. In the face of persistent digital copyright infringements, NFTs promised a novel approach to limitations faced by creatives. Examining them provides a concrete example regarding the legal complexities surrounding new innovations regarding digital ownership and control.

Combining and extending the definitions of Bal and Ner (2019), Regner et al. (2019), and Leech (2022), we adopt Valeonti et al.'s 2021 definition:

> a non-fungible token (NFT) as a cryptographically unique, indivisible, irreplaceable and verifiable token that represents a given asset, be it digital, or physical, on a blockchain.
>
> *(Valeonti et al., 2021)*

There are two ways of understanding an NFT: one restrictive, the other extensive. Strictly speaking, the NFT is only a non-fungible token on a blockchain, that is, one which can't be replaced by a similar or identical token (on the blockchain: a system in which a record of transactions is maintained across computers linked in a peer-to-peer network, see Gayvoronskaya and Meinel, 2021). It has a digital fingerprint that allows it to circulate on the blockchain, to be combined with others in a collection, exchanged, burned, and so on. More broadly, an NFT can be understood as the three elements of the definition together: the token, the smart contract that deploys it, and finally the metadata associated with it. This extensive conception can lead to confusion between a creative work, or a distinctive sign, contained in the metadata – the subjects of copyright – and the token or the digital fingerprint that points to it. This confusion is easily maintained in marketplaces such as OpenSea or Nifty Gateway,[3] which call the intangible images for sale "NFTs." In this way, they create uncertainty, given that with the purchase of an NFT there is also a simultaneous transfer of intellectual property rights. In our approach and in line with the usage in the report of the Law Commission of England and Wales on ownership in digital assets, we adopt a strict conception of NFTs and distinguish carefully between the token on the smart contract (the word "pipe" in Magritte's famous painting) and any object, digital or otherwise, that the token points to.

Given that NFTs are effectively a new form and expression of a contract regarding a digital asset, NFTs are not only for the sale of new, digitally born art. Given the flexibility of their application, they have been posited as a new standard for communication in the creative industries (Shilina, 2021); a way to raise crucial funds for the austerity-stricken gallery, library, archive, and museum (GLAM) sector (Valeonti et al., 2021); a way to define ownership and assist production and marketing in the fashion industry (Nosirova, 2023); a way to provide proof of uniqueness, copyrights, new business models, digital integration, and security in the music industry (Senkardes, 2021); and a way to transform the entire creative economy (O'Dair, 2018). The concept itself is sound; however, there are well-reported difficulties regarding NFTs, which are often not to do with the technology itself but the behaviour and performance of new, centralised players in these markets such as wallet services: third parties that offer new services build around the decentralised

substratum but with much more conventional structures. These new intermediaries not only have traditional business structures but also are disproportionally implicated in many of the recent crypto-asset related scandals and problems (Schafer et al., 2023, p. 3).

Previously we distinguished carefully the token as a digital object from the digital asset to which it "points" – we can think of the difference between a sales receipt and the object that was sold or, in terms of Magritte's painting, the image of a pipe with its metadata that says it is not a pipe and an actual pipe. There is a widespread misconception that acquiring an NFT means acquiring the copyright in the underlying work, but this is not necessarily the case (Grimmelmann, 2022). In the digital economy, the traditional legal framework of the sale of an object is inverted: what the buyer typically acquires is a license to use, with a range of copyright permissions. Not normally acquired is copyright itself, and there is never ownership transfer for the media file in which the work is expressed. How do NFTs change this equation? Applying the distinction between NFT in the narrow sense and the NFT as relation between the token and an external asset, we can first conclude that the NFT token itself probably does not attract copyright – it is, as we said, a smart contract, that is, a piece of computer code. While software is in principle capable of attracting copyright, a short and trivial instruction will not. At the very least, the terminology used by platforms is misleading. However, a separate question is the copyright in the underlying asset: the media file that typically resides outside the blockchain, for instance, a .jpg file with a bored ape. If the underlying file attracts copyright at all, then transfer of the NFT *can* also entail granting of a copyright license. This could be through the way the smart contract itself is set up, through a representation of the license in code, or simply through the terms and conditions of the platform that organises the transfer. Of all of these, the last is the most common and for the buyer also the most fragile – the terms and conditions of the contract can later be changed without this being visible in the NFT. In summary, often the buyer will not acquire even a copyright permission: if they acquire one, it typically operates independently from the NFT.

The vulnerability of NFTs to theft, blackmail, or misuse necessitates clarification within the legal framework and cannot be forced by the technology alone (Pryor, 2022). Even the initial premise of assured authenticity, akin to traditional art ownership, has been disrupted by instances like Dutch artist Lois van Baarle's unauthorised NFT uploads, when over a hundred of her works were uploaded without her permission on the NFT auction platform OpenSea,[4] leaving the "buyers" of these works in a legal limbo (Beckett, 2022). Similarly, OpenSea had to withdraw a NFT of a Jean-Michel Basquiat drawing when the Basquiat estate informed them that the seller did not own any rights to the work (Artforum, 2021). Beyond art, NFTs have extended to novel domains, such as sports. Notably, tennis player Oleksandra

Olinynykova auctioned an NFT offering lifetime rights to a part of her arm for tattoo placement or sale (Hamacher, 2021). This case prompts inquiries into bodily ownership, advertising, and intellectual property rights within emerging digital ecosystems, indicating the complexity inherent to this area: if an artist now creates an image on her skin, and the token is subsequently sold to a third party, what are the rights of the artist who created it? If the new token owner wants to create an avatar of the tennis player for a virtual game and put a digital version of the tattoo on that representation, does the original creator have a say and ability to prevent this from happening (Faulkner III, 2019)? What if the avatar in turn is minted as an NFT; does this require the permission of the player, the artist, or neither because control over the NFT entails full legal control also over the tattoo? The intricacies of this problem now extend beyond prior literature (Hsieh, 2019).

The desire to replicate ownership in the digital space remains strong not just because of an economic imperative but because it resonates with strong intuitions about fairness, identity, and agency. But just as with previous "ownership technologies," NFTs by themselves are at best a pale imitation of the way in which the law understands ownership and therefore do not actually provide a simple solution to ownership and control in the digital domain. They are intangible assets in themselves, an accessory to the dematerialised medium, and this may have an impact on the exploitation of rights surrounding them, including copyright and intellectual property rights. This has given rise to a variety of legal cases where these aspects are being ascertained and adjudicated, and the legal frameworks around them are still being debated (see, for example, Chatain et al., 2021; Zerbib and O'Rorke, 2021). In many cases the law has taken on a complementary role, trying to bridge the gap between technological affordance and legal ideal. But this in turn created new problems and inequities, and in particular shifted the power even further away from ordinary buyers and consumers of digital good and the people who create them towards the technology companies that provide the technical infrastructure for their consumption.

Changing legal systems

Opening up the conceptual space for new forms of ownership in the digital world is an important development to realign our digital economy with legal ideals that are deeply embedded in our legal systems. The internet may have heralded the "end of ownership" because digital assets do not fit into any of the existing categories of "ownable" things. They are not physical objects like pens or land that can be possessed. They are not objects that are created by the legal system, like mortgages and debts, which can be transferred by the operation of the law (what Scots law calls incorporeal things and English law "choses in Action"). Nor are they like intellectual property: while also an

abstraction, copyright operates independent of the medium within which an idea is expressed, while digital assets such as media files are essentially linked to their mode of expression. Recognising a third (or fourth) category of personal property – digital assets, in addition to existing frameworks regarding intangible and tangible items – is an important first step to reclaim territory lost to other legal regimes. It can help to realign public perception and understand their normative relation with the digital objects that they encounter in their lives with the legal understanding of this relation.

In response to these problems and opportunities, in 2022 the Law Commission of England and Wales put an ambitious proposal on digital assets out for consultation. Noting that "Digital assets and methods for the transmission online of things that the market values have struggled to integrate themselves with the law of personal property" (2022, p. 2), for the first time, they proposed that the law will explicitly recognise ownership over some type of data objects. Although their call for evidence and consultation concluded that many aspects of the management of digital assets were already accommodated, and also in their final report (2023) give priority to the court-centric evolution of the law, they do recommend statutory intervention that clarifies the status of cryptotokens and NFTs.

Under this proposal, for a type of digital asset to become ownable, three things have to be in place:

1. it is composed of data represented in an electronic medium;
2. it exists independently of persons (unlike the skin of our tennis player) and independently of the legal system;
3. it is rivalrous (if it is consumed by one user, it cannot simultaneously be consumed by another).

It is the lack of rivalrousness that was traditionally the impediment for recognising ownership in digital assets. To be ownable, an asset has to be rivalrous on its creation, and there must be a mechanism that preserves that rivalrousness when the owner disposes of it, and in particular transfers it to a new owner: previously there has been no obvious way to transfer a digital asset to a new owner so that only that person now has control over it. The Commission concludes that this is still the case for most media files.

However, only a small adjustment in the law is needed to consider cryptotokens, including NFTs, rivalrous and in principle disposable: the concept of possession (the physical control over a thing) needs to be replaced with a notion of "control." If the computational infrastructure is such that, provably, only one person at a time can have control over a token, and furthermore, if the seller demonstrably loses control upon transfer, and the buyer acquires it, then the law should and can recognise this as a transfer of ownership. Blockchain environments provide the mechanisms to achieve and record this

handover of control. For example, NFTs aim, through technological means, to artificially create rivalrousness. As they are non-fungible, they cannot multiply in the way a media file can – every attempt to copy creates a new object. Only the person who has them in their wallet has, at any given point in time, control over them, and if they are sold, this control automatically passes on to the buyer. It is this technological recreation of rivalrousness in the digital domain that made them a "ownership candidate" and the reason such great hopes are associated with them.

Creative industries' feedback on proposed digital assets

As well as a large task for the judiciary, it is a large task for those utilising, creating, monetising, and stewarding digital assets within their creative practice to keep abreast of these potential changes. If enacted, the proposals will have a significant impact on all businesses and users operating within the digital economy. While

> it may open up new business models, facilitate leveraging assets to raise capital, and clarify the status of digital assets in the context of inheritance or insolvency law . . . it also means that many businesses and organisations could find themselves over night new "owners" of assets they did not even know they had, which could also include new duties and obligations.
>
> *(Parry, 2022)*

Business models may need to adjust to make the most of these new rights, and there may be new opportunities for monetisation of work or new obstacles to crucial aspects such as the supply chain.

To prepare businesses and creators for this future, and to ensure that their voices are heard as part of developments to ensure that resulting legal systems are fit for purpose, the DECaDE Centre for Decentralised Digital Economy together with Creative Informatics held two stakeholder forums online in October 2022, with the first focusing particularly on the needs of the creative industries (Creative Informatics, 2022; School of Informatics/Design Informatics, 2022). The forums were attended by 40 attendees, who were a mix of academic researchers and creative practitioners. The various feedback and discussion, gathered using a Reflection-In-Action approach (Schön, 1983), showed that the majority of attendees were favourable towards the principle of reform. Any criticism or disagreement voiced was mainly whether the proposal was far reaching and bold enough. The creation of a new form of property sounded radical and promising for many – but once the details became clear, in particular the limited applicability of the new category – there was with some participants a sense of disappointment. Similarly, there was a recognition that what is being proposed is in large part a restatement,

albeit a more systematic one, of what courts have already begun to develop. While the principle of a third category of property thus found widespread support, the proposed limitations created concerns, and, given the inevitable disruption due to the limited applicability of the new category, there was a sense that it may constitute a missed opportunity that still disrupts current experimentation with these technologies while failing to generate substantial benefits. This would particularly be the case if this revised regime introduces complexities for the cross-border transfer of assets with external jurisdictions such as Scotland within the UK and other entities beyond its borders. The Commission's alignment of its proposals with international advancements was thought noteworthy; indeed, the absence of action could potentially lead to analogous challenges as global dynamics evolve. Nonetheless, apprehensions surfaced regarding disparate developmental paces among different UK regions, particularly evident among stakeholders situated north of the border.

While based on valid considerations, the consolidation of jurisprudence on digital assets and the creation of a third category may inadvertently preempt more radical law reform endeavours prematurely or encumber future court-driven advancements in the field. The ostensibly abstract and overarching nature of the proposed third category warrants examination. It prompts inquiry into whether this framework is excessively tailored to a specific, contemporary technology – particularly one that comes with considerable costs, not the least its environmental impact (Truby et al., 2022). Consequently, it prompts reflection on the true technological neutrality of the proposal and whether it aptly supports the optimal technological trajectory or supports the needs of those operating within the creative industries.

Discussion

How do we solve a problem like reimagining property rights in the ever-changing digital sphere?

The clearest benefits from a statutory intervention regarding ownership and control in the digital economy would be by increasing legal certainty, in particular for people who cannot and do not follow the developments in the courts – such as software developers who will be tasked with building systems that have the type of functionality and affordances crucial for managing the status of digital assets. Providing certainty is crucial to support work in the creative industries, especially for smaller companies and ordinary users of the technology. In addition, allowing experimentation with new forms of control, including joint control, sharing, and openness towards multiple (though not unlimited) controllers is essential if we are to build a functional and evolving creative economy built upon data.

In addition, some of the more technical parts of copyright law could be updated, so that assignment of full copyright through a smart contract

becomes legally valid. Creating an immutable record of this transaction on the blockchain seems an adequate normative equivalent of a written contract. Trusted third parties could generate repositories of typical standard forms of copyright licenses: this would allow also legal and technologically unsophisticated users to see what type of rights they are acquiring. Clarification about the relation between the smart contract, and possibly contradictory terms on the platform that conducts the transaction, would also add legal certainty. This was the aim of the Smart Contract project of the French Ministry of Justice, which could provide an international blueprint.[5] Tighter rules on advertising new technologies and their capabilities, especially by influencers, would be other low-hanging fruit to stabilise the digital asset environment and make it safer for creators and their customers.

Enacting legal changes to the ownership of digital assets in a way which is sympathetic to the needs of the creative industries will require a nuanced understanding and collaboration among legal scholars, computer scientists, and creative industry stakeholders, including creatives practitioners, content providers, and consumers, in order to shape the future of digital property rights and the creative economy. In addition, as this book stresses in Chapter 4, upskilling in data-led methods, including rights and legal frameworks, will be imperative if creators are to navigate this complex, and rapidly changing, terrain.

Conclusion

Opening up the conceptual space for new forms of ownership in the digital world is an important development to realign our current digital economy with ideals that are deeply embedded in our legal system. The creation of a new type of property – digital assets – is to be welcomed, and we broadly support proposed goals and solutions. It is indeed remarkable that the "fourth industrial revolution" – "the new era that builds and extends the impact of digitization in new and unanticipated ways" – (Davis, 2016) managed to prosper without a property regime for its most valuable assets. It may also open the way to new forms of expression or remuneration for the owners of digital assets and the creators who produce new products and services based upon them.

Much of what is currently proposed in changes to the existing property ownership framework consolidates existing creative solutions from the courts, and this may limit some of the disruption that some in the creative industries fear, also making it easier in cross-jurisdiction cases involving international legal systems. An alternative approach, however, which could offer more efficient resolutions to some legal challenges, would be to enact incremental legal adjustments, for example, updating technical aspects of copyright law and implementing stricter regulations regarding digital capabilities.

In either case, to ensure that those in the creative industries are provided with a workable and useful legal system regarding their digital and data-led products and services, their voices need to be heard as legislation is developed, changed, and enacted. Ensuring that the creative industries are aware of their data- and digital-related rights will require upskilling, communication, and support to allow creatives to make the most of their digital and data assets in this rapidly changing space.

Notes

1 https://creativeinformatics.org
2 https://decade.ac.uk/?page_id=227
3 https://www.niftygateway.com
4 https://opensea.io
5 https://smart-contracts.univ-grenoble-alpes.fr/

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CASE STUDY

Breaking new ground with ethically sourced audio AI: DataMind Audio and the development of the Combobulator

DataMind Audio[1] is a pioneering company that operates at the intersection of music and artificial intelligence (AI). Created by musicians for musicians – and led by electronic music producer, educator-entrepreneur, and technologist Ben Cantil – their mission is to produce innovative electronic instruments that leverage the power of AI to expand and augment human creativity and capability in the realm of sound design.

In 2022, DataMind were accepted onto the final round of Creative Informatics' Resident Entrepreneur programme, proposing to use the £12,000 grant to support their five-strong core team in developing a groundbreaking new AI plug-in, the Combobulator.

Using AI-models trained by Stability AI servers on audio from world-class music producers (such as Tipper, Max Cooper, and Mr. Bill), the Combobulator transforms a live audio signal to sound like the selected music producer's unique style. Whilst programming an AI to "hallucinate" an interpretation of an audio signal itself already represents a completely new paradigm for creative sound design, the plugin also comes with many modular controls that will be familiar to all synthesiser users.

During the development of the Combobulator minimum viable product (MVP), DataMind discovered noteworthy outputs, both positive and negative. One of the most significant discoveries was the innovative nature of their online marketplace for ethically sourced neural networks, which will create a new economic opportunity for artists in the AI space. By curating a collection of novel neural networks and establishing a global marketplace for AI-generative implementations of their work, DataMind Audio is providing a new income stream for music producers to earn royalties, addressing the financial insecurity faced by artists. This represents a significant market innovation and is garnering positive attention in the music software industry.

Furthermore, the idea of a neural network marketplace, where trained networks can be sold based on specific artist datasets, has broader implications beyond sound design. This concept could potentially be applied to other forms of media in various creative industries. As AI technologies rapidly expand and accelerate, DataMind Audio aims to actively participate in the conversation surrounding AI's applications in all creative industries.

Participating in the Creative Informatics Resident Entrepreneur programme has helped DataMind's team develop as researchers, audio specialists, artists, and community members. Mentorship was provided by Tinderbox Orchestra's

Luci Holland, whose ongoing guidance and expertise in the UK music industry proved an invaluable resource, providing astute insights which have helped position DataMind for success in the creative industry.

Following their involvement in the Creative Informatics programme, DataMind have produced two working plugins, both of which are in alpha testing at the time of writing.[2] Whilst their primary focus continues to be on further developing the Combobulator, in particular enhancing its security measures to ensure the protection of IP and user data and prevent any potential security or piracy risks, the team are also working on the Refractalizer, which employs granular synthesis techniques combined with AI neural audio synthesis. This represents another exciting avenue to expand the company's portfolio of cutting-edge audio plugins and provides a unique tool for music producers to explore innovative sound design possibilities.

In addition to the production of these tools, this project has also helped the company increase its knowledge and awareness of ethical considerations in the emerging field of AI creativity. Working with AI technologies raises ethical considerations around data privacy and ownership of generated content. The project has deepened the team's awareness and understanding of AI ethical issues and has helped them craft ethical policies for the company's use of artist content for data training.

DataMind are committed to paying royalties of 50% of sales of each model after the initial expense of training the model (£800–£1000) has been paid. On a wider scale, they hope to become a model company for generating ethical training data, working with artists in the AI music space to become the UK's premier ethically sourced AI neural audio software company. They intend to explore further opportunities in funding, marketing, research, and development to achieve these aims.

In November 2022, DataMind Audio Ltd was registered as a limited company. DataMind's initial press release about the tool was featured on the Mr. Bill podcast on March 23 (Mr Bills Tunes 2023). The Combobulator launched publicly in 2024. Whilst the instrument is now more dynamic and expressive than initially imagined, and additional features such as model blending and sidechain functionalities have been identified, further work on resolving inconsistencies in sound quality and processing power usage of models is being undertaken before its full unveiling.

Since their participation in Resident Entrepreneurs, the company has been successful in gaining a further £5,000 of R&D funding through Creative Informatics' Creative AI Music & Audio Pilot Project. Through this funding, they will retrain the Combobulator using an improved version of the current algorithm to enable the tool to scale more quickly and efficiently and reduce the likelihood of it being swamped by larger-scale competitors. They have also recently

been awarded £50,000 by Innovate UK to support several model reliability engineers, who will specialise in training the tool's neural networks in close collaboration with the artists whose styles they will be applying and with ethical considerations at their forefront.

Victoria Murray

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Case study notes

1 https://datamindaudio.ai/
2 See the Combobulator alpha version MVP in action: https://www.youtube.com/watch?v=0qloj5gpz_c

8

DECENTRALISED CREATIVE ECONOMIES AND TRANSACTIONAL CREATIVE COMMUNITIES

New value discovery in the performing arts

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Abstract

While the past decade has seen cuts to public funding to the arts, it has also seen the development of online technologies which have the potential to reach increasingly diverse and global audiences. As a result, individuals and organisations across the creative industries and performing arts have experimented and embraced more diverse, innovative, and direct approaches to engage and monetise tangible support from their audiences and communities. Prior work has identified the evolution of crowdfunding in the arts as a form of 'crowd patronage' – where platforms such as Patreon and Kickstarter function as new intermediaries that can radically reconfigure how and why creative work is funded. The 'pivot to digital' – which brought audiences and creative workers together in new online spaces throughout the pandemic – further reinforced the potential for direct communication and financial support from audiences of creative work. This chapter will reflect on how contemporary data-driven, monetary technologies have begun to decentralise how creative work is valued, supported, and paid for, with a particular focus on the performing arts.

We examine the new frontiers for such 'transactional communities' (Swartz, 2020), reflecting on our own fieldwork and case studies in the so-called 'creator economy' in order to surface their impact upon creative transactions and new forms for the valuation of creative work. These include novel 'creative transactions' on Twitch (Elsden and Speed, 2022), where livestreamers, including DJs, poets, comedians, and many more, leverage a rich suite of highly situated and data-driven monetisation tools to support their practice.

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Beyond these platform economies, we consider the hype and future promises of 'Web3' – where audiences may not only pay to support but might invest, own, hold a stake in, and direct creative communities themselves through distributed ledger technologies, such as non-fungible tokens (NFTs). We consider the implications of a more distributed, automated, data-driven, and audience-led landscape for funding and paying for creative work and suggest how individual freelancers, creative organisations, and institutions can respond to and benefit from the challenges and opportunities these decentralised creative economies represent.

Introduction

The valuation of creative and cultural work is a subject of enduring academic interest.

Philosophically, valuing creative and cultural activities intrigues, as it seems to distil and spotlight tensions between essential human and societal values and economic value. Individual artists face perpetual questions about whether to prioritise lone, esoteric creativity or to 'sell out' and seek commercially viable iterations of their practice. As a marketplace, valuation remains constantly in flux, due to the diversity and uncertainty of creative output (Caves, 2000). Managing this uncertainty requires centralised and institutional actors (e.g. fairs, venues, awards organisations, reviewers, professional bodies) which traditionally hold curatorial power in determining the reputation, worth, and ultimately economic value of new creative work (Moeran and Pedersen, 2011).

As with many other sectors, there have been efforts to artfully account for the value(s) of the creative industries, beyond raw economic output. In particular, appeals are made to more 'relational' approaches (Josifidis and Lošonc, 2012; Bandelj et al., 2017) that account for more than simply price and consider how the economic and social (and, more recently, environmental) are inextricably linked (Zelizer, 1989) in value constellations (Speed and Maxwell, 2015).

Urgent contemporary concerns around economic value in the creative industries have focused upon the precarity and inequality of creative labour (Brook et al., 2020), something which extends to (and in some cases is exacerbated by) the intermediation of online platforms and cultural platform work (Duffy, 2017; Nieborg and Poell, 2018). This has spurred studies of the variety of approaches and strategies through which the majority of those working in the creative industries manage to sustain their practice and ultimately get paid for their work. Elsden et al. take this further still to consider how 'creative transactions' and payments specifically are practically constructed, solicited, and enacted (Elsden et al., 2021; Elsden and Speed, 2022).

In this chapter, we are interested in how valuation practices (Doganova et al., 2014) in the creative and cultural economies in general, but specifically

the performing arts, are being impacted through various forms of *decentralised* and *distributed* technologies which are mediated by online platforms and networks. In particular, we address the emergence and promises of the 'creator economy' (Jin, 2020) and its relation to the much-vaunted Web3 (Voshmgir, 2020). Prior work has looked broadly at the potential implications of blockchains and distributed ledger technologies (DLTs) for artists and the creative sector (O'Dwyer, 2015; Catlow et al., 2017; O'Dair, 2018; Potts and Rennie, 2019). Collectively, these works speak to the disruptive capacity of these specific technologies and their often problematic roots and governance, yet nonetheless offering intriguing alternative economic imaginaries.

For our work, we are especially focused on how digital platforms have broadly facilitated decentralisation and allow individuals involved in the performing arts and their audiences to more directly interact and co-create value (Ranjan and Read, 2016). In particular, we examine the relational and community focused turns, in both the 'creator economy' and Web3, which offer potential for new, plural means of valuation and value-creation to come to the fore, allowing for 'multiplied relations' (Josifidis and Lošonc, 2012) and challenging the dominant economic prerogative that traditionally binds creative practice and the production of cultural value.

To this end, we consider three closely related and overlapping case studies of creative transactions in the performance industry. In distinct ways, each examines how individuals and communities can employ digital technologies to interact and transact in decentralised ways to create and attribute value to creative work. The first is located in the depths of the COVID-19 pandemic and explores what happens when traditional, centralised 'evaluative infrastructures' (Kornberger et al., 2017) (such as box offices and commercial producers) give way and the subsequent improvisation, innovation, and work of individual artists and communities required to replace them. The second looks online, to the growth and success of livestreaming platforms such as Twitch, where 'content' is freely and globally accessible, and a new suite of monetisation tools and tactics are provided for creators to utilise not only for economic but social ends. Finally, we consider novel applications of 'non-fungible tokens' – not simply as a speculative asset but as means to extend, co-create, and share value in a decentralised manner. Together, these case studies demonstrate the various means and implications of decentralisation, as well as indicating ways in which creative practitioners may seek to employ them to engage their audiences.

Case study 1: Paying for Performance in a Pandemic: Edinburgh Festival Fringe 2020 during COVID-19

The restrictions imposed throughout various waves of the COVID-19 pandemic forced the closure of venues and a scramble to find new ways to connect with audiences online. Alongside all the technical challenges of streaming

a performance across the internet are profound questions about how such work should be valued and paid for. Without traditional tickets and box offices, many artists and festivals experimented with alternative 'creative transactions', including soliciting individual donations, 'pay what you can or want' tickets, traditional ticketing, or other kinds of crowdfunding. We interviewed 20 performers, artists, and theatre-makers who had planned to perform at the Edinburgh Festival Fringe 2020[1] to understand their experiences of creating, performing, marketing, and ultimately taking payment for their work online (Elsden et al., 2021a).

The primary hurdle facing artists in this context was a great uncertainty about the value of their practice and the resulting online performances. In part, this arose from the fundamental novelty of the experience for artists and audiences but also since centralised actors – like festivals and promoters – were no longer were able to offer a cohesive programme or play a selective, curatorial role to assure audiences of certain standards or taste. Second, without the traditional festival context in Edinburgh which combines the Fringe Festival, Edinburgh International Festival,[2] and the Free Fringe,[3] an online performance experienced by audiences through a computer or TV screen was suddenly in competition with all and any other kinds of online 'content'. As one stand-up comic put it: "How do we, as Fringe artists and Fringe creators produce something that is the same standard as a Netflix special with 1,000 times less the budget?"

However, even those artists who were able to build and maintain an audience online then faced the challenge of 'converting' or 'monetising' that interest into a viable income. Artists and venues experimented with a range of approaches, from a traditional set amount, paid-in-advance ticket to more variable 'pay-what-you-want' tickets or direct solicitation for audience donations and support. Without traditional box-office infrastructure, there were immediate practical challenges of organising payments with performers and audiences. Here, numerous intermediary platforms, (such as Kofi[4] Buymeacoffee,[5] or Paypal)[6] came to the fore. Likewise, start-ups such as Scottie (detailed in the case study following this chapter), who produce bespoke web and ticketing platforms for creatives, sought to plug this emerging gap. Such platforms illustrate neatly that in the wake of traditional disruption and disintermediation of traditional actors – such as a box office – there are always opportunities and need for reintermediation with new problems and politics (Langley and Leyshon, 2017). It also illustrates the additional labour placed on performers and audiences for decentralisation to actually work. This labour – where performers are faced with directly seeking, justifying, and organising payment for their work – is highly demanding (Duffy, 2017; Bonifacio et al., 2021); however, it also opens the door to a deeper and more direct understanding of one's audience, who can surprise with their capacity to support.

In the era of on-demand streaming platforms, the logic of paying more for a single ticket to an online show than a monthly Netflix subscription broadly

gave way. Nonetheless, despite a desire to perform, many feared the implications of 'training' audiences to stream theatrical work for 'free'. Instead, many creatives looked for means to build longer-term and more sustainable or anticipatory support for their work via forms of crowd-funding or crowd-patronage (Swords, 2017). Platforms such Patreon hence facilitate much more direct relationships between artists and their audiences. For some, it was a daunting expectation to be a regular content provider:

> I worry with Patreon that there is such an expectation that you are going to be constantly putting stuff out. I tend to write one show a year, I don't want to have to write half a show a month for my Patreon subscribers.

For others, the potential of serving a consistent audience online was motivating and encouraged the potential for a new, more engaged relationship with their audience:

> We found that this whole promise of it being content, you know, we'll put content up if you join as a member, and actually that meant there was a motivation for us to continue making that content, as well. And, it also felt more like an artist's community.

The extent to which subscription platforms alone can provide a sustainable income for entire creative teams and companies, as opposed to only individuals, is still a matter of uncertainty in economic terms. However, these platforms do appear to steer (and require) performers to develop a nuanced understanding of how to strategically create and share diverse content developed from their practice (Elsden et al., 2021b). Through these direct, ongoing, and open-ended interactions with audiences, there is the opportunity to discover new things that audiences value and are willing to pay for.

Our primary observation here is how the diversity and experimentation in new forms of direct audience-to-artist payments fosters particular social relations between creator and audience, making space for the value(s) of a creative practice to be surfaced, reconsidered, and renegotiated.

Case Study 2: Creative Transactions on Twitch: Livestreaming Economies and Digitising Valuation

Creative transactions on Twitch

Extending the previous case study, we turn to livestreaming platform Twitch: a frontier of the 'creator economy' (Jin, 2020). While drawing strongly on the culture and professionalisation of live-streaming and video-content production first academically identified on YouTube (Postigo, 2016), Twitch is differentiated by a focus on live, unscripted and long-form 'performance' – not

only of video-game streaming but incorporating all manner of subjects, formats, and artistic genres. Notably, Twitch has remained a highly open and adaptable platform that ferments and captures rich and diverse cultures of payment and valuation (Partin, 2019, 2020).

Much prior work has identified the nature of aspirational (and hence often underpaid) creative labour on Twitch (Johnson and Woodcock, 2019; Woodcock and Johnson, 2019), as well as specific interactions that enable 'digital patronage' (Wohn et al., 2019; Bonifacio and Wohn, 2020) and 'digital gifting' (Lee et al., 2019). In particular, emotional attachment and 'parasocial relationships' with streamers are identified as a key driver of financial support (Wohn et al., 2018). Feeling emotionally close to streamers, despite the asymmetric nature of the interaction, underpins a sense of loyalty, leading viewers to continue their patronage and view their financial support as a form of investment in a streamer and a channel.

More broadly, these specific findings resonate with Zelizer's descriptions of the 'social meaning of money' (1989), where specific kinds of transactions achieve specific kinds of relational work, and vice-versa (specific relations require specific kinds of payment and money). To this end, we have written previously on how the design of various creative transactions on Twitch is underpinned by data-driven and algorithmic logics and produces new relations between distributed viewers and streamers (Elsden and Speed, 2022). For this chapter, however, we wish to focus especially on the implications of livestreaming economies as an example of distributed and digitised valuation of creative work.

A core dilemma, and indeed the appeal of Twitch, is that content is free to access and extremely open ended. Viewers have no obligation to pay and can leave at any time. This is a stark contrast to how a traditional, ticketed performance is valued and paid for. In traditional ticket buying, a predetermined price is decided upon by centralised actors – the artist, venue, or promoter – and then charged up front, usually for a specifically planned performance (known run time, script, setlist, staging, etc.) by an act with some known reputation. Instead, the value of any particular channel on Twitch and any specific livestream is fundamentally always uncertain. It is something to be considered, judged, negotiated, and re-evaluated second by second as the viewer chooses to continue to watch (or not) and whether (and how) to offer any support – financial or otherwise. Additional metrics, such as showing the number of concurrent live viewers watching at any moment, equally serve as means by which the stream is evaluated. However, as previously, audiences are encouraged to pay to 'support the stream' and to be able participate more directly in the social liveliness, games, and communities surrounding a channel.

A compelling example of this includes an automated fundraising drive and 'channel game' known as a 'hype train.'[7] In effect, when a certain threshold of financial support has been reached (either through paid channel

subscriptions or one-off tipping) a hype train is launched. This starts a countdown timer and encourages viewers to collaboratively fundraise towards a target, offering rewards and recognition to those who give the most. If the goal is reached, the hype train continues and sets a new, higher target. If not, the hype train ends, and the stream returns to normal. Crucially, since it is triggered automatically by the platform (if enabled by the streamer), this solicitation appears organic and creates an explicit space for financial transactions to be solicited and prioritised during the stream. Furthermore, the game mechanics and temporality of the hype train are entirely dependent on live, visible transactional data – who pays what and when. And, of course, different streamers 'play' the hype train in different ways.

Through examples like this, we therefore suggest Twitch offers a mature, accelerated, and concentrated version of many of the dynamics we saw in the initial case study, with numerous tools and approaches to decentralisation and monetisation embedded in a single platform and subculture.

Twitch as a distributed evaluative infrastructure

Twitch and other livestreaming platforms can be understood as what Kornberger (2017) describes as an *evaluative infrastructure*. In particular, Kornberger emphasises the multiplicity and distribution of *valuation work* (Doganova et al., 2014; Elsden et al., 2019) that platforms enable, in contrast to more centralised acts of valuation (e.g. setting a ticket price). As such, platforms "are not singular mediating devices that strive for referentiality between objects and representations. Rather, they are ecologies of interacting devices that generate relations (not references) between people's actions, behaviours, preferences and objects" (p. 90).

Crucially, Twitch does not singularly attempt to evaluate every channel in a monetary sense (although the most popular streamers and channels are able to enter into more bespoke arrangements with Twitch as *partners*). Instead, the platform creates an infrastructure which prioritises and emphasises certain values – for example liveness, loyalty, community – by which streamers and their audiences can then develop relations and exchange value – from which, of course, the platform will subsequently extract (Twitch can take up to 50% of the subscription earnings from a channel).

This evaluative infrastructure can be particularly understood through the visibility of metrics used throughout the platform. The most visible and important of these is *concurrent live viewership* – a count of how many people are watching a stream at any moment. This number is often changing, reflecting the liveness of the stream and showing if the audience is growing or shrinking. The duration of the stream is also prominently displayed. A count of subscribers is not shown by default; however, many streamers use overlays to display a subscriber count and even host specific 'subathon' streams

where they aim to reach a specific target (e.g. 100 or 1000). Resources from the Twitch Creator Camp encourage streamers to reflect frequently on the stream summary after each stream, as well as their overall channel analytics.[8] In particular, the stream summary gives a detailed breakdown of audience engagement through an 'activity time graph'.

These and other metrics are also those used by brands and sponsors seeking streamers to advertise and become ambassadors for their products, similar to many other social media platforms (Bishop, 2021). Importantly – most metrics are not actually evaluating the content itself – there are no ratings or up- or downvoting of content, for example. Live 'concurrent viewership' is the most apparent indicator of quality and can determine how easily new streams are discovered and recommended. However, this varies greatly across genres.

Partly through the use of metrics, Twitch creates the conditions and opportunity for performance to be valued and remunerated. However, the valuation work that Twitch itself performs is limited to facilitating user discovery by ordering and presenting channels to the user. The situated work to directly generate economic value and monetise is instead pushed out to individual channels and streamers. The freedom and flexibility afforded to streamers in how to approach monetisation of their performance is important because it allows for very localised and situated negotiation of the value of an unbelievably diverse range of content and experiences – Twitch could not possibly adequately act as a typical cultural intermediary – in the way a festival curator might – to directly set the value of particular channels.

Hence, Twitch supports and provides numerous data-driven monetisation tools to streamers – thereby *distributing valuation work*. Such tools illustrate the growing diversity in *how* audiences can pay and financially support creative work as a transactional community. For streamers, a great deal of care is required to do this appropriately, and inclusively, without the perception of 'selling 'out'. In various resources and guides, successful Twitch 'Partners' explain the importance of ensuring payments and transactions occur 'organically', where an audience pays to support a stream because they want to rather than because they feel they have to. In effect, streamers must construct the channel and stream something worth paying for while at the same time ensuring a fun and inclusive community, regardless of viewers capacity to pay. Indeed, the most successful streamers appear to co-create very localised framing and situations for transactions to take place with their audiences, producing particular subcultural social relations and capital in the process (Thornton, 1996). For example – one RnB DJ, 'BellaFiasco',[9] who streams later in the evening, solicits donations at the same specific time of night (10.34pm), when she invites viewers to collectively take an alcoholic shot with her. '10.34' is then reproduced as a meme through various communications and chat messages during every stream.

Furthermore, there is a secondary degree of decentralisation. Although streamers construct opportunities for transactions to take place, it is viewers themselves who are also expected to do considerable valuation work and ultimately conduct evaluative acts in real time as they watch and interact with the stream. We see, therefore, while platforms carefully mediate, manipulate, and capture value (Partin, 2019), that the actual valuation work is pushed away from a centralised actor and distributed all the way down through streamers and their channels to the viewers themselves, as a very live form of crowd-patronage (Swords, 2017).

As such, despite decentralisation on the front end where value is created and exchanged, it's important to acknowledge the dependence on powerful centralised platforms that remains. Hence, in this case study, we see how cloud-based internet platforms enable the distribution and decentralisation of valuation work – but ultimately retain control and extract considerable value as they do so. In our final case study, we consider the potential of much-hyped Web3 technologies (Voshmgir, 2020), where the monetisation tools and platforms themselves can be further decentralised, and the implications this has for valuation work.

Case Study 3: Tokenising the Creative Economy: NFT Ticketing

Web3 and the 'creator economy'

An underlying concern with Twitch (and most other contemporary internet platforms) is the scope for the platform to unilaterally extract (and abuse) the value co-created laboriously between streamers and their audiences. Web3[10] – where digital infrastructure is built upon distributed ledger technologies, with the potential to decentralise the ownership, governance, and value capture of web platforms – instead promises "a decentralized and fair internet where users control their own data, identity and destiny" (Web3 Foundation, 2023).

Li Jin – a leading venture capitalist in the 'creator economy' (2021) – describes the potential opportunities for creatives and online content creators as shifting the balance of power from platforms to creators and their audiences. In particular, Jin identifies the importance of enabling forms of digital scarcity and facilitating direct investment and ownership in the success of creative careers and outputs – via 'tokenisation' (Voshmgir, 2020). The crux of these arguments is thus: tokens (recorded and governed in a decentralised, trustworthy manner by an underlying blockchain) can be used to assign value(s) to the investment, labour, and contributions that participants provide to a particular platform or ecosystem. In addition, they offer means to produce digital scarcity – where access or use of digital applications

and media is predicated on possession of a unique token. As such, tokenisation could enable alternative economies, recognising new forms of value co-creation and exchange – beyond the dominant 'attention economy' of Web2.0, where users access content for free while their attention is monetised via the placement and engagement with advertisements (Crogan and Kinsley, 2012).

An early example of ambitious Web3 principles is the social media network Steemit, where participation on the platform (posting and engaging with content) is ranked and rewarded via a native token currency (Li and Palanisamy, 2019). In addition, token holders have means to vote and participate in the governance of the platform. They may also benefit from the growth of the network over time, as new users invest in the Steemit token. In the context of the 'creator economy', numerous Web3 platforms have sprung up to disintermediate (and subsequently reintermediate) livestreaming, crowdfunding, ticketing, crowd patronage, and online marketplaces. Key aspirations of these efforts include distributed platform ownership and governance, particular incentive mechanisms via 'tokenomics', and the ability to independently create, record, and recognise ownership of new digital assets – better known as non-fungible tokens.

Much has been written previously on the various imperfect opportunities of blockchain technologies for the creative and cultural industries (O'Dair, 2018; Potts and Rennie, 2019; Patrickson, 2021), but it is the potential applications of NFTs specifically as means to mediate and exchange value that we wish to focus on here. NFTs gained notoriety throughout 2021 as a speculative asset class. Decentralised marketplaces such as OpenSea[11] facilitated a combination of crypto-marketing schemes and speculative art auctions, leading to astronomical sales of digital artworks and collectibles – in particular digital avatars, such as the 'Bored Ape Yacht Club.'[12]

However, since the wider collapse of crypto markets, attention has returned to the more fundamental nature of NFTs as means to programmatically define, assign, and share scarce digital assets (O'Dwyer, 2020). Essentially, tokens can be designed and programmed to work in very specific ways. For example, tokens might be non-transferable, expire after a certain time, or only be tradeable between certain actors. In addition, these tokens may contain specific data, often referencing particular media or assets, in such a way that they can be used to designate ownership and enable particular rights and actions. Based on a tamper-resistant and publicly visible distributed ledger, tokens can also be used to track provenance – and to show exactly how and when tokens (and related media or assets) were created and subsequently exchanged between various parties. The envisioning of NFTs as a new decentralised infrastructure for *ticketing* offers an instructive case study to consider some of the practical applications of these mechanics.

NFT ticketing

Tickets sold for a show or live event can already be understood as a form of token. They are often non-fungible (each ticket is unique and can't be equally exchanged for another) and provide the holder means to demonstrate and enact certain rights, such as accessing a venue. Contemporary ticketing faces several well-documented challenges: preventing the sale of 'fake' tickets; 'touting' and 'scalping' through excessive secondary markets (where tickets are resold for astronomical sums); the static and limited single use of tickets; and challenges of integrating and sharing ticketing data between artists, venues, and promoters.

NFTs are envisaged as offering potential solutions to these challenges, in addition to enabling other decentralised applications. To explore this, in 2022, we collected web content and promotional materials from more than 40 NFT ticketing applications and start-ups to analyse the key features being proposed for NFT ticketing and to consider the wider implications of decentralised ticketing infrastructures.

Primarily, these companies sought to draw upon the provenance and immutability of a distributed ledger as means to manage the whole ticket life cycle, from the moment a ticket is created, through to its sale, use at an event, and even afterwards as a souvenir or proof-of-attendance. A ticket – normally a token of, or reference to, a contract between a venue and audience member – can become a decentralised, digital asset. However, there is much variation in how specific companies ultimately seek to apply core blockchain capabilities, depending often on the particular market or context that they are prioritising.

Some companies envision NFT ticketing for online and metaverse streaming experiences, others position services for promotors and event organisers, and some seek to integrate with existing large ticketing infrastructures and standards, while others are situated entirely in a Web3 paradigm and focused upon facilitating 'token-gating' – providing ticketing services built upon existing NFT collections and applications.

Across these contexts, a set of recurrent features are promised and predicated on specific aspects of distributed ledger technologies. Drawing primarily on the affordances of DLTs to support immutability and provenance of digital objects (as in other supply chains (Rogerson and Parry, 2020)), the primary use case is to prevent the use and exchange of fraudulent tickets and set particular terms and conditions about their resale in secondary markets. For example, ticket resale might be fixed at the original price, or royalties can be automatically passed on to the original artist or venue for each resale. Through smart contracts – immutable, executable code, secured in a distributed ledger (Levy, 2017) – these tickets can hence become programmable and act in automated and autonomous ways. Tickets might be switched 'on' and 'off', up- or downgraded to grant additional rights, have dynamic value, or

be able to interact with other digital infrastructures. In addition, one might be able to independently prove the ticket was used and demonstrate proof of attendance for some future benefit or reward. Aligned with other popular NFT projects, unique digital media can be packaged and related to the ticket to serve as a form of collectible item.

As ever with blockchain-based technologies, the reality of implementation rarely matches the hype, and it is challenging to evaluate the success and feasibility of many of these proposed applications yet at scale. In addition, we see varying degrees of decentralisation and several points where these systems are required to interact with centralised and physical infrastructures in the real world – often undercutting claims about the decentralised and 'trustless' nature of distributed ledger technologies in isolation. Indeed, it is notable that potentially the most successful implementation of an NFT ticketing application for large concerts at Wembley Stadium[13] has been delivered by an existing large, centralised ticket provider (Secutix).[14]

However, crucially, most of these proposals position the ticket as an open and independent platform for audience and fan engagement, before, during, and after the primary live experience. They also imply a high degree of data collection and analytics in an anonymous but highly shareable way. Furthermore, as decentralised media, in most cases, the ticket issuer or venue no longer holds a monopoly on the data or ability to validate a ticket. Hence, an individual ticket-holder could easily prove the authenticity of their ticket to anyone else, and other service providers such as taxis, hotels, other event promoters, and other artists could reliably identify, check, and offer new services to ticket-holders of an upcoming or past event. Likewise, the artist or venue themselves issuing the ticket can theoretically maintain, trace, and build ongoing relationships with any ticket-holder without depending on a specific platform or institution. Ticket-holders may hence be part of an ongoing transactional community – with social and economic relationships with each other long after the performance itself.

These propositions come laden with caveats and critique about their implementation in practice and associated concerns around data protection and ethics, accessibility, and ease of use, alongside the responsible innovation of any new technology. And, as ever, while clearly disintermediating some problematic aspects of centralised ticket ecosystems, we should question how new intermediaries would develop and be sustained ethically and financially in a decentralised system. However, this emerging area offers a helpful sketch of how NFTs and Web3 could enable new creative transactions and valuation.

Conclusion

Taken together, these three case studies aim to unpack how various forms of decentralisation and ultimately distributed technologies can impact creative transactions (Elsden et al., 2021) and the valuation of creative work. Initially,

we described how artists experimented and evolved their approach to payments and valuation when traditional, centralised infrastructures receded or collapsed during the COVID-19 pandemic. Here, we see two key, recurring issues: how disintermediation always incurs reintermediation and the tremendous additional labour required in decentralised systems. However, we also see examples of creative workers engaging in and discovering new ways in which audiences value and are willing to pay for their work. In our second case study, we saw the acceleration and formalisation of many of these dynamics captured in live-streaming platform Twitch. In this case, we see the design of highly novel creative transactions that enact particular relational work between streamers and their communities. We also see the value and implications of highly public transactional data come to the fore. Drawing on Kornberger et al.'s work (2017), we suggest that the highly customisable and open-ended way in which transactions are constructed and take place on Twitch is an example of a distributed evaluative infrastructure. Despite this, it is evident how Twitch retains considerable power as a centralised platform and is able to extract great value from the considerable labour and valuation work undertaken by others.

This set the scene to consider the potential of distributed ledger technologies and the heralded Web3 as part of a creator economy. In particular, we examined proposed applications of NFTs to provide ticketing services and infrastructure. From this final case study, it is worth now highlighting some key distinctions that distributed technologies appear to offer with regard to especially valuation, in contrast with previous case studies. Via 'smart contracts', transactions of tokens can be programmed to execute in very specific ways. This implies that the creator of a token or ticket can transparently enforce particular rules or policy, and hence values, through a transaction. Through decentralisation, this programming (or valuation work) should not be easily changed or undermined without a wide base of support from those who participate in and sustain the network. While there is clearly fragility and vulnerabilities in many crypto-networks, it is (in theory) much harder for a single individual or company to unilaterally change the terms of how transactions work – in the way that a platform like Twitch might. In addition, transactional data and decentralised media shift from being commercial property of large platforms and companies to public and distributed assets – that can be appropriated and engaged with more easily by others. There are therefore new opportunities for value co-creation (and value destruction) (Bozeman, 2002), where a range of actors can potentially exploit and develop new services and business models based on these distributed assets. More broadly, while Swartz (2020) describes the potentially closed and exclusive nature of transactional communities produced through customer rewards schemes or exclusive credit cards, decentralisation may offer means for more open-ended, co-created, and relational transactional communities between peers. Thus far, crypto communities have tended to be more purely economic

and market-driven, premised upon investing together in speculative assets for individual gain – but this need not necessarily be the case (Lustig, 2019).

Moreover, we suggest that the broadly recognised (yet perpetually hard to evaluate) social and cultural values of creative practice offer a fertile context in which to explore and develop more sustainable, socially oriented and equitable applications of decentralised technologies. Perhaps one way to positively envision the ambitions of the 'creator economy' is to allow for 'multiplied relations' (Josifidis and Lošonc, 2012) where there are numerous opportunities to construct and exchange value, allowing for more nuanced relational work (Zelizer, 1989) between creators and audiences. Speed and Maxwell likewise urge consideration of how creative practice participates in and produces networked 'value constellations', rather than simply adding value at a point along a linear value chain. In the context of performing arts that we have considered here, we have seen how decentralisation through variety of socio-technical infrastructures creates conditions for audiences to interact more directly with artists, co-producing and consuming creative content. Yet more cynically, the creator economy could be understood as a series of efforts to monetise these value constellations most efficiently.

Ultimately, we should be cautious to view DLTs exclusively as any kind of panacea for the numerous, deep-rooted issues and inequalities facing the creative and cultural industries (Brook et al., 2020). However, the radical roots and essentially systemic thinking underpinning most decentralised technologies helps pose important questions of traditional value systems and creates space for rich new imaginaries around creative transactions. In our broad-based prior design-led research on these technologies (Murray-Rust et al., 2023), we have frequently found that DLTs help break down assumed hierarchies and valuation systems and provide means for individuals and communities to take greater agency in how their work and contributions are valued. This is what we wish to finally emphasise as the primary implication of the varying degrees of decentralisation we have discussed in this chapter.

We encourage creative practitioners, cultural workers, and performing artists to reflect on where the valuation work (Doganova, 2014) truly takes place in their practice and institutions. To what extent could this be reclaimed or challenged through new, more decentralised creative transactions? While undoubtedly laborious, it is striking the extent to which iterative and direct engagement with audiences enables artists to (re)discover means to transact and co-create value together. Larger cultural institutions might reflect on how, like Twitch, they might function more as a trusted, distributed, evaluative infrastructure (Kornberger et al., 2017) – providing tools and platforms for audiences and artists to mediate their value in new ways. And though remaining wary of new platform intermediaries, we encourage cultural workers to identify and seize the means of valuation wherever they can – through experimentation with Web3 technologies or otherwise. Now, perhaps more than ever, there exist means to reconsider and redesign the very

building blocks of how we transact with each other; creative practitioners should be at the heart of finding new ways for people to create and exchange value together.

Notes

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2 https://www.eif.co.uk/
3 https://freefringe.org.uk/
4 https://ko-fi.com/
5 https://www.buymeacoffee.com/
6 https://www.paypal.com/paypalme/
7 https://help.twitch.tv/s/article/hype-train-guide?language=en_US
8 https://www.twitch.tv/creatorcamp/en/level-up/channel-analytics/
9 https://m.twitch.tv/djbellafiasco
10 https://web3.foundation/about/
11 https://opensea.io/
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CASE STUDY

Supporting fundraising and digital distribution during the COVID-19 pandemic: Scottie and Fringe of Colour

Scottie,[1] is a performance ticketing and content management system founded by Connie Girvan and Creative Informatics' Creative Bridge alumni Andrew Girvan. Like the theatres and cultural and performing arts organisations that were their market, Scottie faced an uncertain future in 2020 because of COVID-19 lockdowns and were looking for new ways to support their business and develop revenue streams.

Scottie made an application to the Creative Informatics Resident Entrepreneur programme in March 2020 proposing a rapid turnaround project that would allow them to pivot their platform to support digital distribution fundraising tools specifically tailored to the performing arts. The proposal aimed to address the immediate needs of the sector by supporting online sharing of work and the opportunity to raise money to support its survival but was also designed with a long-term vision for the utility of digital technologies and data-driven innovation for the performing arts in mind.

Over the course of three months, Scottie worked with local design agency Eido Studio to produce additional functionality for their service that enabled users to not only sell tickets but also undertake fundraising and offer access to content by subscription. The speed of the work supported by Creative Informatics meant that Scottie was able to develop the subscription content aspect of the platform in time to support the industry's moves towards virtual or blended distribution during the COVID-19 pandemic and beyond. They also worked in consultation with arts organisations preparing Arts Council England and Creative Scotland funding applications, allowing Scottie to add value to those bids and position themselves as the preferred supplier for digital tools if their applications were successful.

Scottie's 'pivot' addressed a particular challenge experienced by smaller performing arts and events organisations during the pandemic who did not already have relationships with developers and established streaming and subscription platforms to allow for sharing work via digital means. Scottie's shift in offer and business model – which aligns with the themes of Chapter 10 in its consideration of the ways in which digital tools and platforms can decentralise and redistribute the co-creation of value between performers and their audiences – has meant working with more and new partners and suppliers.

One of the earliest performing arts partners to work with Scottie was Fringe of Colour.[2] Fringe of Colour is a multi–award-winning Edinburgh-based

initiative launched in 2018 to support Black people and People of Colour at arts festivals in Edinburgh, Scotland, and further afield, as artists, workers, and audience members.

The organisation was founded in response to the scarcity of shows performed by Black people and People of Colour at the Edinburgh Festival Fringe and established a publicly accessible and crowdsourced database of shows where at least 50 percent of people on stage are Black people or People of Colour. In 2019, it supported a free ticket scheme which provided People of Colour to access shows by Performers of Colour at the Edinburgh Festivals. In 2020, in the midst of the performing arts sector's pivot to online content due to COVID-19 lockdowns, Fringe of Colour noticed the same scarcity of performances by Black People and People of Colour that had prompted its founding. In response, they created their own festival, Fringe of Colour Films, to continue to support the communities they work with.

Fringe of Colour were particularly concerned that:

> with festivals and live events cancelled and a necessary move towards the virtual, we noticed that many organisations gladly fell back on the 'safe'; read: white, straight, cis, able-bodied, neurotypical, wealthy or middle class, for online content. (Fringe of Colour, n.d.)

Scottie worked with them to enable the delivery of the first edition of Fringe of Colour Films, a platform that celebrates creative work of Black, Asian, Indigenous, and Latine people in Scotland and around the world.[3]

In spring 2020, Fringe of Colour Films launched an open call for work, as well as commissioning a range of filmmakers and artists to create short works. The films were then made available, through Scottie's newly developed subscription tool, as part of a paid-for limited run online in August 2020. The film content was distributed through Scottie's platform and accompanied by online events as well as thoughtful reflective responses as part of the wider Fringe of Colour website. The festival received extensive coverage, including pieces in Scotland,[4] the UK,[5] and the US.[6]

Fringe of Colour have continued to work with Scottie as a delivery partner through two further editions of Fringe of Colour Films in 2021 and 2023.

Vikki Jones

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Case study notes

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9

ON CREATIVE PRACTICE AND GENERATIVE AI

Co-shaping the development of emerging artistic technologies

Matjaz Vidmar, Drew Hemment, Dave Murray-Rust, and Suzanne R. Black

Abstract

In recent years, advances in artificial intelligence (AI) and machine learning have given rise to powerful new tools and methods for creative practitioners. 2022–2023 in particular saw an explosion in generative AI tools, models and use cases. Noting the long history of critical arts engaging with AI, this chapter considers both the application of generative AI in the creative industries, and ways in which artists co-shape the development of these emerging technologies. After reviewing the landscape of generative AI in visual arts, music and games, we propose four areas of critical interest for the future co-shaping of generative AI and creative practice in the areas of communities and open source, deeper engagement with AI, beyond the human and cultural feedbacks.

Introduction

The last half a century has seen advances across a range of technological domains, including artificial intelligence (AI), as well as in new imaging and immersive techniques. The last decade in particular has seen major breakthroughs in machine learning, and recent developments in diffusion models and large language models have given rise to powerful and widely accessible generative AI tools. In 2022–2023 AI-powered image generators and chatbot assistants have exploded into the mainstream and the public consciousness, with some declaring a "golden age for AI art" (Faber, 2022). This has led to unprecedented opportunities for artistic creation but also profound concerns about the implications for professional artists and society at large.

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These AI capabilities can underpin new forms of creative practice and fuel transformative experiences for audiences across the creative industries, including performing arts, visual arts, music, museums and heritage, games, film/TV, digital media, advertising and creative design. A comprehensive review of some of the key creative AI technologies and their uses can be found in Anantrasirichai and Bull (2022). Extending to "(i) content creation, (ii) information analysis, (iii) content enhancement and post production workflows, (iv) information extraction and enhancement, and (v) data compression" (Anantrasirichai and Bull, 2022, p. 589), the wide-reaching scope of these technologies is challenging to engage with, both for creators as well as their audiences.

While we are wary of hype cycles, this is a moment in which many creators are exploring the implications of AI for their own practice (Cremer et al., 2023) and voicing their perspectives on the profound upheavals that these developments bring (Hemment et al., 2023a). We see important changes in human–computer creativity. Authorship and audience experiences are becoming ever more digital, networked, algorithmic and complex. Conversational agents, virtual characters, interactive robots and other autonomous technologies are increasingly becoming part of creative content. This transition goes beyond the simple adoption of new formats or technologies: we are entering into a whole new context for making, sharing, learning, connecting and consuming.

With new capabilities come new challenges. The complex algorithms of AI are often black-boxed, with their operations and assumptions not accessible to human understanding. The outputs of the new generation of platform-based tools, such as recently released text-to-image generators, appear like 'magic', with little scope for human intervention or creative control. Often, the only creative input is through a text prompt, and the generative models that underpin the current tools are largely trained on massive datasets scraped from the internet without permission or fair pay for the original content creators (Wu, 2020). Other urgent concerns include excessive energy use, harmful bias and misinformation. With the release of ever more powerful generative AI tools, issues that were previously considered niche concerns within data science have become increasingly mainstream ethical minefields.

At times of social and economic upheaval, artists are often at the forefront, helping to illuminate the ways emerging technologies impact on life at a profound level (*Ibid.*). A specific interest in this chapter is critical arts, or critical AI arts, where creative practitioners directly engage in the politics, ethics and philosophy of AI, and in its capacity to challenge and inform as well as to delight audiences (Hemment et al., 2022). Artists expose and explore the sublime, the indefinable, what we can't put into words (Ingram, 2023), and the outputs of the statistical lens of AI are often uncanny and

preternatural, beyond what is normal or natural (Hemment et al., 2019). Artists are currently pushing at the boundaries of human–machine creativity to generate works that combine machine learning methods with human intuition and embodied experience.

In this chapter we provide a brief overview of creative practice concerning generative AI, with a focus on practical examples in visual art, music and games to highlight some priorities for emergent areas of study. This chapter argues that it is necessary to equip cultural producers and artists to negotiate political, legal, security, ethical and environmental controversies and challenges in emerging technologies and formats and to develop best practices.

The case study associated with this chapter offers more examples of how this can be done in practice. In it we describe the work of the research group and creative community The New Real,[1] a joint initiative of the University of Edinburgh and the Alan Turing Institute, in which some of the authors of this chapter are involved and which is intimately concerned with the previous challenges and themes. The New Real has the twin ambitions of supporting the creation of significant new art and inspiring new concepts and paradigms for fair and inclusive AI, which it advances through its novel research theme, experiential AI (Hemment et al., 2019).

A brief history and current landscape of creative use of generative AI

The current explosion in creative practice using AI has been fuelled by recent developments in generative AI systems that can generate new data that is similar to existing data. This is used to generate synthetic media, which can be used in the creation of new and unique works of art. Looking further back, artists have experimented with AI since the very early days of the field (see Taylor, 2014; Victoria & Albert Museum, n.d.). During the late 1960s, Harold Cohen developed AARON at the University of California at San Diego, marking an early milestone in the realm of AI art. AARON utilised a symbolic rule-based approach to generate technical images with the aim of automating the process of drawing. Initially producing basic black and white drawings, AARON evolved to the point where, by 1995, it could also paint using chosen brushes and dyes without Cohen's intervention (Garcia, 2016). Since then, AI has been of specific interest to a variety of artists internationally (see Cetinic and She, 2022 for an excellent overview).

Over the last decade, many artists have begun experimenting with generative adversarial networks (GANs), which emerged in 2014 (Ridler, 2017). These algorithms feature two 'adversarial' networks competing with one another: a generator creates images that could pass as real, whilst the discriminator ('adversary') attempts to distinguish real images from fakes, creating a feedback loop that produces increasingly realistic images. Google introduced DeepDream in 2015, utilising convolutional neural networks

within a generative process to enhance patterns in images and create exaggerated visuals (Mordvintsev et al., 2015). This release sparked the development of various apps that transform photos into art-like images resembling famous paintings.

With a degree of open source access to advanced machine learning systems and, with many smaller-scale neural network architectures and models also becoming available, creative coding communities were able to adjust existing machine learning protocols, pre-trained systems and publicly available datasets (e.g. ImageNet)[2] to their individual needs and begin to incorporate them into their creative workflows. For instance, ArtBreeder,[3] launched in 2018, employs models like StyleGAN and BigGAN to allow users to generate and modify images ranging from faces to landscapes and paintings (CV Notes, 2019). Increasingly we have seen multi-modal models that can incorporate text, images, keywords and configurable parameters such as artistic style. With the release of cloud-based text-to-image models such as DALL-E 2,[4] Midjourney,[5] and Stable Diffusion[6] and the Large Language Model-based ChatGPT,[7] which is capable of creating humanlike conversational dialogue, generative AI has become preeminent in the public perception of this emerging technology. Through these generative AI tools, the text prompt has become established as the dominant user interface, which has limitations such as reproducing biases inherent in language and a tendency to use English as default but has also inspired creative exploration.

However, widely applied deep learning algorithms are increasingly complex and difficult for a human to understand (Sarker, 2021), and they encode knowledge in ways that even experts may not be able to explain (Xiang, 2022; Yalçın, 2021). Many of the current generative models are trained on data scraped from the public internet without attribution or fair pay for the original creators (Blackman, 2020). By extracting existing features in historic data – a set of observations in the present day or the past – these systems inherit biases from the data they are trained on and so can reproduce and further entrench inequality and discrimination against certain groups of people (Kundi et al., 2022). Indeed, most AI design fails to incorporate concerns around fairness, social justice or intersectionality (age, gender, ability, ethnicity) as factors in the designs of technical systems (Crawford, 2021). In addition to these ethical concerns are dire environmental consequences. Operating AI currently requires a vast amount of energy, and the Information and communications technology (ICT) sector overall is estimated to generate around the same level of greenhouse gas emissions as international aviation (Trueman, 2019). Moreover, the massive server farms required for data processing are often located in some of the most fragile parts of the world and require rare minerals; this can be ecologically destructive (Monserrate, 2022).

In addition to these very real concerns, there are complex combinations of conceptual, technical and social issues that challenge public interpretation of the 'intelligence' of these tools. Salles et al. offer grave misrepresentations

that portray these technologies as if they were people (2020), and Elish and boyd critique the use of magical language to sell the potentials of AI systems (2018). But AI does not possess intent independent of its functionality, it does not have ideas beyond responding to queries and it does not have a personality to express: it generates outputs based on statistical reasoning. It is important to note that the current state of the art AI/machine learning models are still based on stylistic rather than conceptual reasoning. These are not knowledge models, but image/music style models or language models. Though portrayed as autonomous, current AI systems also depend on 'ghost workers', hidden human hands, who annotate and moderate content, knowingly (Wakefield, 2021) or even unknowingly (Morreale et al., 2023). This creates a new underclass of people to do this very low-paid work, who have to find and mark for deletion sometimes traumatic content, which is often outsourced to developing countries. This leads to further centralisation, with more control and money channelled to a small number of companies large enough to make the investments, amplifying the most corrosive aspects of capitalism (Moore and Woodcock, 2021; Prug and Bilić, 2021; Kwet, 2019).

Today there exist numerous generative AI platforms, ranging from consumer-facing mobile apps to Jupyter notebooks that leverage powerful graphics processing units (GPUs) for effective execution. For example, Stable Diffusion is free to use on personal hardware as well as extendable by third parties. This has been built on through the development of applications and extensions, including plugins for popular software like Krita,[8] Photoshop,[9] Blender[10] and GIMP.[11] Tools that help artists to create using AI/machine learning technology are particularly interesting. At the time of writing, there is a relentless stream of new possibilities for engaging with large models: ChatGPT returns text that is increasingly accurate based on text prompts; Stable Diffusion, Midjourney and DALL-E are competing to see who can generate the most appealing images while tackling current flaws such as representing human fingers; RunwayML[12] is demonstrating incredible text-to-video-editing possibilities; and, as discussed subsequently, four different large models that carry out some form of text to music have been released (OpenAI's Jukebox, Boomy, Loudly, Google's MusicLM). However, there are more creatively interesting questions around tools that expose rather than hide, provide conceptual analysis rather than simply generate images and in particular help creative practitioners get to grips with the unique and quirky parts of working with AI/machine learning.

In contrast to these emergent generative AI tools, creative production has been supported by frameworks and communities that provide insight into how to make use of these new technologies. For example, libraries and toolkits that bring together components in a relatively easy-to-use form have supported a profusion of audio/visual interactive pieces[13] and have started many people on their creative coding journeys[14] in areas like facial recognition.[15]

Making use of these tools is becoming more fluid – where in the 2010s playing with a model would involve an afternoon of solving software version conflicts to install it locally, ml5.js allows models to be seamlessly loaded into a web browser for immediate exploration. The latest round of prompt-based models clearly offers the lowest barrier to entry – simply typing in a textbox or joining a Discord chat allows one to ask a model to generate something.

However, these tools limit not just what can be done, as users are limited to a given setup and way of working, but also conceptually how we understand creativity. In the middle ground, where the user retains a connection to the code, there are collaborative notebooks (e.g., Google Colabs),[16] which were initially created for data science and programming tasks, that run code on other people's servers, meaning that even large models can be explored and demoed without installation. As an example, Gene Kogan's ML4Artists[17] offered a collection of artistically useful models with code that could be run on Google's servers allowing quick and easy exploration of technical possibilities. Now, new models appear on Hugging Face[18] and other model sharing platforms, allowing immediate access to the possibilities of transforming, classifying, modifying and generating material. Although openness of access to these tools and resources is welcomed by artists, significant investment of time and high levels of existing technical skill and scientific literacy are still required.

Use of generative AI in creative practice

AI in visual arts

The arts have historically served as a site where marginality and transgression can challenge or expose dominant structures in society. In the last decade, a vibrant community of artistic practice has developed around the use of AI (Grba, 2022; du Sautoy, 2019; Miller, 2019). In the visual arts in particular, there has been widespread critical engagement, with artists working with AI to address topics such as bias in machine learning datasets or exploitative labour practices, exposing their harms and reimagining these systems in more ethical and just ways. Over this period, the large number[19] of recent exhibitions dealing directly or obliquely with AI and machine learning are a strong indicator of the increasing focus placed on AI technologies among artists, curators, and audiences alike. Media attention has been drawn to AI generated images sold for high value at auction[20] and the ease with which even a discerning eye can be tricked (Glynn, 2023). However, the truly groundbreaking applications of AI by artists are not always so high profile.

In cultural contexts, AI technologies can find many different uses, with artists often building their own tools and datasets. Examples include relatively simple tools designed to augment human creativity (e.g. ArtBreeder;

Zeilinger, 2021a); more complex systems capable of creating quasi-creative expressions autonomously (e.g. Adam Basanta's AI-driven art factory *All We'd Ever Need Is One Another*;[21] Zeilinger, 2021b); and purpose-built, generative AI systems through which individual artists express themselves creatively (e.g. Helen Sarin's 'neural bricolage'[22] and Matthew Plummer-Fernandez' 'cave paintings').[23]

For many artists working with machine learning algorithms, the interest is rarely only in optimising prediction accuracy. Instead, their work often focuses on the mistakes, 'glitches', the unknowability of the black-boxed process of AI systems and the poetry (Grba, 2022) that can result from these. Art enables humans to experience the surface effects of underlying structures and reveals them as variously delightful, poetic, troubling and extraordinary (Hemment, 2019). This is especially so in art forms that work with highly complex emerging technologies such as AI. In effect, creative practice using generative AI often looks for the technology to express that which is most human: intuition, provocation and imagination.

Artists address complex and multi-dimensional societal issues alongside aesthetic and technical themes when working with creative applications of AI. There is a long tradition of artists doing more than using AI as a tool by questioning and challenging problematic aspects of its implementation through critical practice on emerging digital technologies. This has given rise to an established and vibrant international community of artists developing creative work with AI that seeks to address intractable controversies and problems in the digital economy and which responds to ethical, political and environmental concerns relating to the widespread implementation of AI and data systems across all sectors of society (cf. Coeckelbergh, 2020; Sinders, 2019; Hemment et al., 2022).

AI in music

Just as in visual art, there is a long history of composers, musicians and sound artists making use of technologies under the broad banner of AI in their practice. This is accompanied by an exploration of the possibilities of computational mechanics more generally, for example, the compositional approaches of Max Matthews MUSIC systems[24] and Lejaren Hillier's Illiac suite,[25] which used algorithmic rules to create musical pieces (Irvine and Rafikian, 2019). Increasing computational capacity paved the way for increasing interactivity, for example, in George Lewis's Voyager system (Lewis, 2000), Blackwell's swarm music (Blackwell, 2007) or work in multi-agent musical systems (Tatar and Pasquier, 2019), which explored how agents might adjust to improvisational structures (Murray-Rust and Smaill, 2011) or the evolution of melody in societies (Miranda, 2003). Other examples of AI in music can be found in Pachet's 'Continuator' (2003), which carried out fluid musical exchanges with various kinds of musicians by learning short term models

of their playing and carrying on in the same vein, and 'Musical Metacreation' (Pasquier et al., 2017), which explored the agencies between musicians and algorithmic systems both in composition and live – and observed the emergence of Algoraves at the intersection of coding and clubbing. A fuller investigation of the creation of machines that make art and music can be found in Bown (2021).

There has been a long and fruitful connection between musicians and algorithms of various sorts, as part of an expansion of musical practice. This can be seen in the development of various tools and communities. Fiebrink's Wekinator package (Fiebrink et al., 2009) places the interactional affordances of pattern matching within reach of musicians. The FluCoMa project packages fundamental algorithms in deployable forms (Tremblay et al., 2021) allowing composers and improvisers to engage with the technical affordances of mapping and exploring large corpora of sounds. RAVE, the Realtime Audio Variational autoEncoder (Caillon and Esling, 2021), encodes the sonic characteristics of one source, which can then be used to reconstruct other audio – a kind of sonic style transfer – with space for creative manipulation along the way. Machine listening can help even without making a sound: Rawlinson's UNISSON (Rawlinson and Pietruszewski, 2019) creates a graphic score to make sense of what is happening when people play live to guide players and listeners alike.

At the time of writing, the explosion of generative algorithms is already established within music creation. Google's Magenta[26] labs initially created a set of tools that would generate note-based melodies and has since expanded into creating neural net models of timbre and musical surface. OpenAI's Jukebox[27] has managed to generate somewhat coherent complete musical excerpts – including almost intelligible vocals – from scratch. This capability to generate 'sui generis' has the potential to change the nature of musicking,[28] just as generative models have altered the practice of creating visual art. AI music startups, such as Boomy[29] and Loudly,[30] as well as established players, such as Google's MusicLM,[31] generate pieces of music in response to text prompts, creating relatively generic, genre-based music in seconds. The possibility for appropriation and deepfakery is ever present, as vocal models moved from the /r/VocalSynthesis subreddit to make headlines with cloned versions of Drake and The Weeknd, which some fans prefer to their current work (Paul and Millman, 2023). This question of authenticity and voice in the face of generative AI will be returned to at the end of the chapter.

AI in games

The games industry is driving the development of intensely immersive, personalised and large-scale experiences and infrastructures in which the use of generative AI will only increase. However, it should be noted that there is a fuzziness around the term 'artificial intelligence' when it comes to video

games with multiple overlapping technologies (such as procedural generation) coming under that umbrella; we are reminded that fully realised AI games are not widespread at time of writing (Bedingfield, 2023), although the industry is moving very quickly.

One step on from the use of procedurally-generated gameplay elements that are long-established in videogames is the harnessing of generative AI tools like ChatGPT, Stable Diffusion, Dall-E and Midjourney to generate dialogue, story and visuals (Farias, 2023). For example, the text-based adventure AI Dungeon[32] mimics a traditional text adventure interface but has used successive versions of GPT to generate the game text. Integrating AI-generated text with text-to-speech is the 2023 murder mystery game Vaudeville,[33] which uses ChatGPT to generate dialogue that responds to player actions and choices in real time, with the aim of creating a more dynamic and engaging narrative experience. Meanwhile, Midjourney has been used to generate 3D environmental and character assets (Seavon, 2023).

For many, the aim of AI in games is individualisation and customisation where generative AI could be used to personalise gameplay experiences for individual players by learning from their gameplay data and creating customised game content that caters to their preferences and play style (Powell, 2023; Zhao, 2020), a technology that is being developed by UK company Charisma.ai.[34] This commitment to virtual production in the screen industries can also be seen in the UK Research and Innovation's Convergent Screen Technologies and performance in Realtime (CoSTAR) programme, which is supported by government and industry investment.[35] While game developers are leveraging the power of AI to create games that are more engaging, personalised, and immersive, there are a number of games that reflect the dystopian threats conjured by AI, such as Cyberpunk 2077[36] (2020).

Discussion: the future of AI through art, the future of art through AI

Here we discuss some of the emerging themes that we see across artistic use of generative AI technologies, and then present some promising directions and priorities for practitioners and researchers, that are central to our ongoing research (Hemment et al, 2023b).

The rise of the packaged, 'black-boxed' tools described earlier creates new spaces and possibilities but can also displace existing practices and ways of thinking. These collaborations can play out in different ways: algorithmic tools become part of the repertoire of practice that creators can draw on. Practitioners create in concert with their tools, and this in itself can provide new creative opportunities. For example, generative tools such as Boomy or Midjourney shift a lot of agency towards the platform. While they allow many people to create via a series of textual prompts, resulting in a level of surface finish that would otherwise take extensive practice to develop, a large bulk

of the creative decisions and interpretations are taken over by the tool itself, blurring the agency of creation (Anantrasirichai and Bull, 2022). With such generative AI tools, the work has already been done – to create the artworks used as training data, to curate training datasets and to train the models – so that the creative engagement of the end user is limited to being narrowly textual. At the other end of the spectrum, within the musicking of one of the author's bands – Raw Green Rust[37] – there is an ongoing question of how to manage this assortment of agencies through which decisions are handed over to algorithms: does the AI get to decide which parts of created music are 'interesting' and should be kept as material to work with?[38] Does it decide who is allowed to be heard at a given moment, to manage meso-structure in the music? Or does it develop its own voices through matching and regurgitating fragments of previous playing in response to current activity?

Both of these approaches highlight new ways of working whereby generative systems produce more complexity and detail than is given to them. However, they have a different relation to the practitioners – both in their aesthetics as well as the practice of the AI's presentation to audiences. There are key questions to keep in mind as generative technologies are brought into readiness within more accessible tools: when interacting with systems to create work, what are the parts of the process that are shared? Which qualities do people keep hold of and which are passed over to the system? Which part of the final output does one feel responsible for, and how does that relate to what we value about creative practice?

Critical art plays with these aspects of AI in what has been termed a "generative turn" in the creative industries (Crawford cited in Cowan, 2023). Much creative practice is to some extent a social process, and

> To arrange pixels or notes in such a way as to achieve individual social goals, as humans do through processes deeply ingrained in our biology and culture . . . cannot be achieved merely by training a neural network to generate patterns, even if those resulting patterns may pass as something a human would have made.
>
> *(Bown, 2021, p. 9)*

Critical AI recognises that technologies are not separate from their circumstances of creation, effects on the world or place in society, and raises questions about the configurations of agency at play within the creative process or creative practice.

Finally, there is the question of what relation the work itself has to the AI that is used. This can be almost incidental: the 'interactional affordances' of AI (Murray-Rust et al., 2023). An AI platform's ability to recognise faces, derive posture from video, identify sounds and so on can be deployed as a standard part of a creative practitioner's toolbox without it being particularly 'about AI.' However, a strong strand of work – of particular interest to The

New Real group (as explored in the associated case study) – uses creative practice to explore and communicate the functioning and implications of AI. Works such as Memo Akten's *Learning to See* (2017)[39] highlight the compositional, synthetic nature of generative models by resynthesising a live camera feed based on natural images. Jake Elwes' *Machine Learning Porn* (2016)[40] articulates the way that content filters implicitly contain the things that they are filtering out. Vera van der Burg's work (discussed in the following), as well as Rafael Lozano-Hemmer's *Zoom Pavillion* (2016)[41] and Trevor Paglen and Kate Crawford's *ImageNet Roulette* (2019),[42] all engage with the practice of labelling, and how the choice of labels affects experience in different ways. Lozano-Hemmer offers a stark articulation of the process of surveillance, Paglen and Crawford highlight issues with fundamental datasets used to build multitudes of models and van der Burg makes labelling a creative practice through labelling objects not with nouns but abstract qualities and other semantically disjointed concepts. The experiences created through AI can be deployments of the technology in the service of other experiential goals, explorations of the spaces of the new possibilities, critiques of the ways the systems work or are created.

Taking into consideration both our understanding of the field of creative use of generative AI and the lessons learned from the creative practices of The New Real (see case study), we highlight what we see as priorities for contemporary and future developments and research. We have termed these areas: (a) communities and open source, (b) deeper engagement with AI, (c) beyond the human and (d) cultural feedback. These priorities provide signposts and a set of pertinent questions for practitioners and researchers to consider in their co-shaping of intelligent systems.

a. Communities and open source

Artists have been driving community-centred approaches to machine learning, and we see the beginnings of an open-source movement around generative models in general (Spirling, 2023). Moreover, Sarah Ciston argues that we should move away from harvesting ever more data indiscriminately and building larger, generalised, centralised models and instead move toward more equitable, purposeful and community-led approaches: namely, conscientious dataset stewardship, small dataset curation, data sovereignty and reimagining machine learning models from scratch (Ciston, 2023). In an echo of remix and sample culture (Rostama, 2015), some artists are building communities around open data and tools and embracing the ability for others to generate new instances based on their own prior work. Holly Herndon has created a digital twin, Holly+,[43] a custom voice instrument and website that allows anyone to upload an audio file and receive a download of that music sung in Herndon's own distinctive voice. This same idea has been picked up

by Canadian singer Grimes, who invites other musicians to create new songs with her voice using AI (Cain, 2023).

b. Deeper engagement with AI

With creative practice it is often necessary to develop more intimacy with the technology – to go beyond crafting prompts and into the deep structures where code and culture collide. The New Real Observatory, for example, enables artists to probe and explore a model, to ask questions of AI and to generate meaningful art. Rebecca Fiebrink's Machine Learning for Musicians and Artists course (Fiebrink, 2019), as well as the Wekinator[44] package (Fiebrink and Cook, 2010), both set out to give creative practitioners the tools to understand the ways in which machine learning operates, supporting the fluency needed to appropriate the tools for their own use. Practices need embedding, and the FluCoMa[45] project seeks to do exactly that by building a community of artists through creating the tools and uncovering the practices needed to allow 'techno-fluent' musicians to relate data-mining and musicking (Tremblay et al., 2021). On the more critical end of the spectrum, Parag Mital's *Cultural Appropriation with Machine Learning* (Mital, 2021) teaches key concepts and techniques in machine learning with a constant eye to how it interferes with the cultural sphere.

c. Beyond the human

A rich source of opportunities for creative practice is through developing the decentralised perspective of AI systems into a more-than-human way of thinking (Coulton and Lindley, 2019; Giaccardi and Redström, 2020). For example, moving from robots that can be read as active agents to more specifically engage with AI through a more-than-human lens, Lauren Lee McCarthy's '*LAUREN*'[46] has the author playing the part of a decentralised AI assistant with views into people's houses and living situations, providing voice assistance and surveillance in equal measure. This decentralised viewpoint is taken even further in Stross's *Rule 34* (2012), a novel written (spoilers) from the point of view of a disembodied AI that takes on the pathologies of whoever is its locus of interest. Here, the idea of AI provides a rich playground for creative possibilities.

In the other direction, particularly drawing on emerging trends in design and the use of metaphors to engage with AI technology (Murray-Rust et al., 2022), Nicenboim explicitly uses more-than-human ideas to re-think relations between humans and generative AI systems – for example, what would happen if you grew a conversational agent like kombucha? While speculative, this creatively rethinks what it is to train, live with and co-perform (Kuijer and Giaccardi, 2018) with a generative AI system (Nicenboim et al.,

2023). In a related vein, van den Burg's *Strange Labelling* questions how the labels applied in image recognition generate relations with the world by using a collection of unexpected, whimsical, conceptual labels superimposed on everyday objects. This creatively reinterprets both the successes and failures of machine vision algorithms to create a poetic space constructed from the algorithmic viewpoint (van der Burg et al., 2022). Creative practice with generative AI allows us to explore these viewpoints, to provide alternative ways of interpreting the world or play with different standpoints to create from.

d. Cultural feedback

As a final point, there is now a mixing between machine generated and human generated work. The prospect of training on 'clean' data recedes as previously AI-generated text and images seep into the public sphere. As the agencies of creation blur, and the products of creative practice entangle with the development of next year's models, feedback is created in an increasingly complex space. The notion of feedback between creators and algorithms is not new: content distribution and recommender algorithms responded to material that was in turn tuned to the algorithmic gaze (Möller et al., 2020). Genres and styles serve both for human navigation and machinic classification. The current change is around the intimacy of the feedback: once the same kind of thing is being produced and consumed, the loop tightens. As Alvin Lucier (1981) or any guitarist knows, with tight feedback, the qualities of the space come to dominate the structure of the material. Working in this generative paradigm, we can ask: what are the fixed points and attractors of this new space? Where does the feedback cycle settle down? Does it push towards and support an infinite drabness of relentless generation or do we find again the value in human vibrancy? How is generative AI evolved with practice in a respectful, inclusive and ethical way? And how do we ride this wave creatively and joyfully?

Conclusion

This chapter has introduced technical, creative and conceptual factors in the use of generative AI in creative practice. We looked at the long history of critical arts engaging with AI, and the current landscape of generative AI use in visual arts, music and games, to understand both the possibilities for artistic production and critiques of dominant tools and models. By reflecting on the current creative use of generative AI, we identified four priorities and future avenues of research and practice combining human and algorithmic concerns. In light of the contemporary prominence of generative AI tools, these four dimensions are already shaping and, we predict, will continue to shape creative work and its interpretation. In such a fast-moving field we

can only ever present a snapshot of the present and surmise which areas of concern will become prominent. But attention to these concerns – and related political, legal, security, ethical, environmental and social concerns – will allow us to redefine how we understand art, creativity, originality and humanity itself in the context of these emerging technologies.

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Notes

1 www.newreal.cc
2 https://www.image-net.org/
3 https://www.artbreeder.com/
4 https://openai.com/dall-e-2
5 https://www.midjourney.com/
6 https://stability.ai/stablediffusion
7 https://chat.openai.com/
8 https://krita.org/en/
9 https://www.adobe.com/products/photoshop.html
10 https://www.blender.org/
11 https://www.gimp.org/
12 https://runwayml.com/
13 https://forum.openframeworks.cc/; https://opencv.org/
14 https://processing.org/; https://p5js.org/
15 https://ml5js.org/
16 https://colab.research.google.com
17 https://ml4a.net/
18 https://huggingface.co/datasets
19 https://www.moma.org/calendar/exhibitions/5535; https://www.deadendgallery.nl/; https://www.barbican.org.uk/hire/exhibition-hire-barbican-immersive/ai-more-than-human
20 https://www.christies.com/features/A-collaboration-between-two-artists-one-human-one-a-machine-9332-1.aspx
21 https://adambasanta.com/allwedeverneed
22 https://www.neuralbricolage.com/more-about
23 https://www.plummerfernandez.com/works/cave-paintings/
24 See for overview: http://120years.net/music-n-max-mathews-usa-1957/
25 See for description: https://distributedmuseum.illinois.edu/exhibit/illiac-suite/
26 https://magenta.tensorflow.org/
27 https://openai.com/research/jukebox

28 A descriptor that encompasses all musical activity (Small, 1998).
29 https://boomy.com/
30 https://www.loudly.com/
31 https://google-research.github.io/seanet/musiclm/examples/
32 https://aidungeon.com/
33 https://bumblebeestudios.itch.io/vaudeville
34 https://charisma.ai/
35 https://www.gov.uk/government/news/ambitious-plans-to-grow-the-economy-and-boost-creative-industries
36 https://www.cyberpunk.net/gb/en/
37 https://efi.ed.ac.uk/events/antagonistic-sextet-a-performance-by-raw-green-rust/
38 https://www.research.ed.ac.uk/en/publications/regulatory-capture
39 https://www.memo.tv/works/learning-to-see/
40 https://www.jakeelwes.com/project-MLPorn.html
41 https://www.lozano-hemmer.com/zoom_pavilion.php
42 https://paglen.studio/2020/04/29/imagenet-roulette/
43 https://www.hollyherndon.com
44 http://www.wekinator.org/
45 https://www.flucoma.org/
46 https://lauren-mccarthy.com/LAUREN

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CASE STUDY

Experiments in building experiential AI systems: The New Real

We write this case study as practitioners involved in a research group and creative community called The New Real,[1] a joint initiative of the University of Edinburgh and the Alan Turing Institute,[2] which is intimately concerned with exploring the ways artists can push creative boundaries with AI and how AI can be enriched or challenged by critical art. In our work, we have the twin ambitions of supporting the creation of significant new art and inspiring new concepts and paradigms for fair and inclusive AI. Our research framework, experiential AI, in which AI is made tangible and explicit, to fuel cultural experiences and to make AI systems more accessible to human understanding (Hemment et al., 2019, 2023), seeks to transform how people engage with different types of content in individualised and also shared intelligent experiences. Crucially, this work identifies both transformative applications of AI in the creative sector as well as ways in which critical arts can help society navigate profound transformations brought about by new technologies.[3] As a research group, we develop technologies, commission artists, publish design tools and advance new thinking.

The Zizi Show – an AI art commission

In our first collaboration with an artist, in 2019 we started working with London-based visual artist Jake Elwes to support them to develop a new body of artistic work and to deepen our understanding of the strategies used by artists to develop critical understanding and literacies of AI.[4] The artistic outcomes include *Zizi – Queering the Dataset*,[5] which premiered at Preternatural at the Edinburgh Festival Fringe in 2019,[6] and *The Zizi Show*,[7] which was commissioned in 2020 by The New Real, and presented at Edinburgh International Festival in 2021, with a major new multi-channel video installation edition of *The Zizi Show* commissioned by V&A in 2023.

Of these, *The Zizi Show* (The New Real, 2020) is an online interactive artwork in which a generative adversarial network (GAN) has been trained on digital video footage of 13 diverse drag performers, filmed at a London cabaret venue during the COVID-19 lockdown. This work exposes the latent space of the machine learning model and highlights the way the model outputs are shaped by the training data. Where many generative works have been trained on opportunistically collected data, the purposeful curation of Zizi's dataset explores the question of how human identity is represented within complex models. *The Zizi Show* develops this through digital avatars that have been created from a model trained on video of real performers to create an interactive

work that allows user control. It connects low level technology to high level social, cultural and political aspects of AI, such as ideas of cultural appropriation and machine bodies. It exposes the limits of machine intelligence and inverts what is otherwise a deficiency in the technology through a positive use of deep fake technology, in which a marginal identity is celebrated and embellished rather than obscured or misrepresented. The work has the power "to influence, to educate, and to entertain" (Parry, 2021) and is a unique output of the collaboration between artist and AI. *The Zizi Show* highlights the ways data and design choices shape what machine learning does. It specifically targets anthropomorphised misrepresentation of AI by constructing an AI persona, and then deconstructing it, exposing its construction in software by the human artist.

The New Real Observatory: an experiential AI platform

In a later project, we brought together artists and scientists to address limitations of contemporary generative AI applications. Collectively we tested methods to give artists increased access and control over an AI model and to creatively explore a machine learning dataset. The outcome is The New Real Observatory,[8] an experiential AI platform developed with and for creatives. Using our platform, artists can iteratively curate data by training an AI model and creatively exploring the results. They define the dimensions they want the algorithm to explore and use simple tools to probe the latent space. The first release of the platform in 2022 worked with images and generative adversarial networks. We have developed bespoke tools such as including a slider visualisation tool as an accessible interface to explore the latent space without the need for users to run their own code.

In its first phase, three artists – Inés Cámara Leret,[9] Keziah MacNeill[10] and Lex Fefegha[11] – used this web-based platform to create artworks that challenge audiences to develop new environmental sensibilities.

Three artworks were presented at The New Real Pavilion at Ars Electronica 2022,[12] and the second iteration of the platform is being tested through five artist development awards and an artist commission in 2023, funded by the Scottish AI Alliance.[13] In the early results, we are seeing how more granular control of the model can contribute to transformative experiences for audiences and open new thinking on key challenges such as authorship, consent, harmful bias or energy use.

We believe it is essential to adopt a more ecological approach to AI, one based on care for the planet and each other. We have seen highly imaginative artistic forms and novel modalities of experience in the work of our collaborating AI artists. The range of projects offers a glimpse of diverse practices,

aesthetics, and strategies that are being used by AI and data arts practitioners. They reveal the extraordinary potential of artificially intelligent technologies used in creative and artistic contexts, and enable us to see different configurations of artistic, technological, societal and environmental work and themes.

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Case study notes

1 https://www.newreal.cc
2 https://www.turing.ac.uk/
3 https://www.newreal.cc/publications/illuminating-the-new-real
4 See https://www.newreal.cc/artworks/the-zizi-project

5 https://www.jakeelwes.com/project-zizi-2019.html
6 https://inspace.ed.ac.uk/preternatural-data-lates/
7 https://www.jakeelwes.com/project-zizi-show.html
8 https://www.newreal.cc/platform
9 https://www.newreal.cc/artworks/the-overlay
10 https://www.newreal.cc/artworks/photographic-cues
11 https://www.newreal.cc/artworks/the-thames-path-2040
12 See https://www.newreal.cc/events/arselectronica2022
13 https://www.scottishai.com/
14 See https://www.newreal.cc/community

10

LIVE EVENTS, DIGITAL TECHNOLOGIES, AND DATA-DRIVEN INNOVATION

Lasting impacts from the pandemic pivot to digital

Vikki Jones and Chris Elsden

Abstract

This chapter will consider the extent to which the 'pivot to digital' reported in the cultural and live events sector during COVID-19 lockdowns has brought about lasting impacts on in-person, digital, and hybrid live events. Through case studies, it will explore methods for research in this space that can sensitively explore digital and data literacies in both cultural production and consumption, in the context of broader economic, social, and cultural challenges around inequities in the sector. By considering possible and preferable futures for the development of online and hybrid programmes towards new modalities of experience beyond the pandemic, the chapter will argue that these digital adaptations and transformations – which consuming culture during COVID-19 accelerated – are part of a bigger conversation about data, platforms, digital media, and modes of performing liveness.

Introduction

While the global COVID-19 pandemic impacted all subsectors of the creative industries, live cultural events were particularly affected through cancellations and curtailments brought about by successive lockdowns in 2020 and 2021. The pandemic and lockdowns, which began in the UK in March 2020, brought about rapid shifts in cultural programmes, performances, festivals, and events. As we continue to emerge from COVID restrictions, live cultural events may be presenting more like pre-pandemic experiences than expected, but research and cultural programming are continuing to explore which legacies of digital and online programmes can and should be retained to support

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innovation, continued development of new technologies for performance, and access to events for audiences.

This chapter will particularly focus on the following research and reports conducted during emergence from the pandemic in the Edinburgh and southeast Scotland region: Creative Informatics' project looking at experiences from the online Edinburgh Festival Fringe in 2020, which undertook research with Fringe artists and producers as strict lockdowns were in place and when those working in the events sector were most drawn to new approaches and experimentation (https://creativeinformatics.org/research/learning-from-the-2020-edinburgh-festival-fringe/); The *Future Culture Edinburgh* symposium in 2021 (Jones and Cunningham, 2022), which explored attitudes to increased awareness of inequities in Edinburgh's cultural sector and ideas through which to address them; and Creative Informatics' 2022 Creative Horizon 3 project looking at how digital technologies and data-driven innovation can support equitable and sustainable festival futures, which produced the fictional, speculative cultural magazine *FestForward*, set in summer 2030 (https://www.festforward.org). These projects captured both a sense of fatigue with the restrictions that were placed on production and consumption of cultural events during successive lockdowns, and an atmosphere of hope and excitement at the prospect of the return of more familiar frameworks and formats of live activity. In the rush of cultural workers and audiences towards traditionally held views of the value of 'liveness', ways of making and consuming culture that arose or became more developed during the pandemic – particularly work involving digital technologies, platforms, and data-driven approaches – were put to one side.

However, this chapter will argue that these digital adaptations and transformations – which consuming culture during COVID-19 accelerated – are part of a bigger conversation about the role of data, platforms, digital media, and modes of performing liveness as we look beyond the pandemic. It will consider the extent to which the 'pivot to digital' (Walmsley et al., 2022), initiated and accelerated through 2020 and 2021, has brought about lasting impacts on in-person, digital and hybrid live events. Supported by case studies and the expanded *FestForward* case study which supplements the text, it will consider methods for research in this space that can sensitively explore digital and data literacies in both cultural production and consumption. It will consider the role of research as a catalyst for exploring digital and data-driven futures for live events and appetite for, and literacies and resilience of, continued development of online and hybrid programming for co-creation of new modalities of experience. In addition, it will explore the evolving role of physical places, cities, or designated spaces as hosts of live experiences – particularly in the context of Edinburgh and southeast Scotland's festivals – and the potential of a relationship between online, offline, and hybrid programming as both an opportunity and a challenge in empowering the cultural sector and its audiences.

COVID-19 and the cultural sector's 'pivot to digital'

From March 2020, when in-person cultural events were suddenly no longer possible due to lockdown restrictions, and for much of 2021, cultural organisations in the UK and many other countries around the world embarked on what has been termed a "pivot to digital" (Walmsley et al., 2022). In 2022, the Centre for Cultural Value (CCV), based in Leeds, UK, published the *Culture in Crisis*[1] report, based on research about cultural organisations' outputs and audiences during the pandemic. The report found that cultural organisations, particularly those that were already literate in digital ways of working, were able to quickly adapt their offer to audiences through producing and delivering digital and online rather than live events. This is shown to have been embraced by existing audiences and policymakers as an example of the creativity of the cultural sector and its vital role in offering positive reasons for the public to stay at home (Bakhshi and Fazio, 2020). Yet, with a broader and longer-term lens, the 'pivot to digital' is shown by the CCV report to have had little impact in terms of extending digital practice to other cultural organisations or in reaching new audiences:

> Those who had previously invested in digital data practices and technologies were better prepared to realise new digital and hybrid forms of engagement than those who lacked the capacity to embrace digital strategies to engage communities in their programmes and collections, beyond their institutional walls. Audiences who were already highly engaged found new, digital ways of enjoying the arts and cultural content; those who were less interested pre-pandemic remained so in 2020.
>
> *(Walmsley et al., 2022, p. 5)*

In addition, regarding any longer-term impact of digital adaptations related to COVID-19, and on the value of digital as part of the sector's engagement with audiences going forward, the report states that:

> digital distribution is not the great equaliser or diversifier that much of the sector was hoping it was or even claiming it to be.
>
> *(Walmsley et al., 2022, p. 68)*

However, this is not to say that there are no recommendations here for continuing digital production and audience development strategies. This is partly, as the *Culture in Crisis* report acknowledges, because this is often the requirement of cultural policymakers (Walmsley et al., 2022). However, it also suggests that targeted experimentation with digital technologies and content as part of a 'hybrid' strategy of bringing audiences gently back to live experiences and could be part of a long-term strategy of engagement with audiences through which "Digital innovation can make a positive difference"

(Walmsley et al., 2022, p. 68). This positive difference could relate to maintaining the economic value of the UK performance and events sector, but also in considering its social value. The report recommends a longer-term approach to considering how the UK's cultural sector might recover from the pandemic that includes a 'pivot to purpose', which is identified by the Centre for Cultural Value as a "general strategic shift" (Walmsley et al., 2022, p. 64) towards a recalibration of cultural value for workforces and audiences, and the cultivation of a values-led culture through which to enact that recovery.

For Edinburgh and southeast Scotland, the impact of the COVID-19 pandemic was felt on the cultural sector, festivals, and events both directly and indirectly through their relationship with the city's also badly affected tourism infrastructure. This is particularly notable in Edinburgh, where destination marketing for the city's cultural status often leans heavily into its framing as the "world's leading festival city."[2] In a study of arts festivals in South Australia, which was contemporaneous to the *Culture in Crisis* report, Ruth Rentschler and Boram Lee identify this link between cultural destination tourism and live events and state that:

> There is now incentive for the industries [tourism and events] to work together.
>
> *(2021, p. 45)*

They identify three areas of transformation in South Australia's arts festivals sector: from an international to a local focus, from competition to collaboration, and a shift towards digital. In considering the values-led perspective put forward by the *Culture in Crisis* report through the lens of a pivot to purpose, Rentschler and Lee are somewhat more pragmatic, stressing the importance of being aware of the relationship between the "conceptual" and the "empirical" in studying the impact of COVID-19 on the arts (2021, p. 38) and of "flexibility" (p. 49) in considering the qualities we now look for in a festival and a cultural destination as we move away from the pandemic. The case studies included here document a renewed sense of purpose towards addressing inequities in access to the cultural sector and the potential role of digital technologies and data-driven innovation to help with that process.

This chapter builds on these ideas by exploring this concept of a digital shift during the COVID-19 pandemic and beyond, looking specifically at the perceived and recorded impacts of a 'pivot to digital' and its effects as cultural events and performances have returned. It incorporates experiences of cultural sector workforces and audiences in the production and consumption of live events mediated by digital technologies and data. While the following case studies are all situated in the Edinburgh and southeast Scotland region, the findings from this collected research speak to experiences from the wider lens of the UK's cultural sector, as well as to the implications of

digital approaches to accessing 'Edinburgh' as an imagined cultural destination from outside the city.

Case studies

Learning from the 2020 Edinburgh Festival Fringe

In June 2021, researchers from Creative Informatics published a report[3] based on a study of the experiences of Fringe participants in 2020. The research recorded the remarkable circumstances that made an in-person Edinburgh Festival Fringe impossible in 2020. It reflected on responses through digital technologies from artists, producers, and venues and sought to begin to identify longer-term shifts that might come about in the performing arts and events sector.

The research documented a broad public response to Fringe events that were (and were not) able to take place online in 2020 and interviewed performers, writers, producers, and promoters about the specific challenges they faced. The project identified three broad areas of recommendations for future exploration and development: for performers, for festivals and venues, and for researchers and designers around opportunities to harness the rituals associated with the experience of attending an in-person performance and ways to consider new forms of liveness through digitally mediated cultural production and consumption.

Future Culture Edinburgh

Future Culture Edinburgh[4] was a one-off symposium event, developed and delivered by University of Edinburgh researcher Vikki Jones with freelance creative and cultural commentator Morvern Cunningham, which took place at Edinburgh's Leith Theatre on 1 September 2021. The event and a report of its findings[5] explored a participatory framework based on action research and reflection-in-action principles (Schön, 1983) through which stakeholders – with a focus on traditionally underrepresented voices – could imagine possible and preferable futures for the city's cultural sector.

The event included presentations by a diverse group of speakers including artists, writers, cultural leaders, and researchers, alongside workshop activities. These were designed to encourage participants to begin to identify the values, actions, and collaborations through which collective action towards a more equitable sector might be enacted. In late 2021, when the region had been able to produce live, albeit restricted, events, the programme for this event required sensitivity to the mood of the sector at the time. There was a sense that post-pandemic futures were very much uncertain and that the precarity of work in the sector had both unified those who were struggling and

exposed and exacerbated inequities of access to careers in the city's cultural ecosystem.

FestForward Magazine (see also following case study)

In 2022, Creative Informatics undertook a Creative Horizon project,[6] which asked how digital technologies, data-driven innovation, and online platforms for performance can support equitable and sustainable futures for festivals in Edinburgh and southeast Scotland in 2030. Working in partnership with Glasgow-based futures design researchers Andthen,[7] the project interviewed people working in and supporting the region's festivals, which informed the design and delivery of a series of participatory futures workshops.

Participants were invited to become speculative 'journalists' for *FestForward Magazine*, Scotland's leading cultural publication in a fictional 2030. They responded to imagined 'provotypes' – low-fidelity cultural artefacts that frame and prompt the envisioning of a scenario – of possible digital futures by writing magazine article headlines. These headlines were developed by the research team to produce a print and digital summer 2030 edition of *FestForward*.[8] The magazine has been used by researchers, policymakers, and cultural and festival organisations as a creative way to stimulate conversations about possible and preferable digital futures and ways to develop equitable and sustainable approaches to digital and data-driven technologies at, with, and through festivals.

Digital, hybridity, and liveness in live performance

Research conducted with Edinburgh Festival Fringe participants in 2020, and interviews with festival workers in Edinburgh and southeast Scotland in 2021–22, document broad perceptions of the value of digital technologies and data-driven innovation for cultural events and performances. In 2020, the cost of producing 'quality' digital content and performances with high production values, compounded by restricted access to such services and the loss of revenue from not being able to perform in person, left many Fringe artists and producers feeling unable to compete with large organisations able to release high budget recordings of lavish performances, such as London's National Theatre.[9] However, many Fringe participants also embraced the challenge of a 'pivot to digital' and spoke positively of the opportunity to explore new ways of creating and distributing their work and building more direct relationships with their audiences. Researchers observed cultural workers becoming more strategic 'content creators' – engaging in online economies and striking a balance between distributing live and recorded content across various platforms (Elsden et al., 2022).

Speaking to those working in and around festivals about their experiences of digital programmes during the pandemic and exploring their hopes and expectations for digital festival futures (the work that led to the creation of *FestForward Magazine*; see case study), participants reported positive responses from both existing and some new audiences to digital programmes in 2020. These findings built on the research conducted with Edinburgh Festival Fringe participants in 2020, when the focus was more on the nature and immediate effects of digital adaptation. However, by 2021–22, these events were becoming situated in the broader trajectory of returning to a more 'normal' model of festival delivery. In these later interviews there was a strong sense that for many cultural organisations working with small teams and small budgets, there were challenges involved in resourcing and supporting digital programmes beyond the digital marketing activities that were already embedded pre-pandemic. Creative Horizon Project participants also reflected on and reported a broader sense within the sector that in the rush to get back to 'normal' live performances, the appetite for any lasting adoption of digital adaptations had been put to one side.

During COVID-19 restrictions, the term 'hybrid' – loosely describing events and activities that incorporate both online and in-person elements – became widely used not just to describe public performances and events but for private meetings and as a term to define adaptations to our working lives. For cultural events and performances, notions of hybridity and experimentation during lockdowns took digital and online performance beyond the recording and subsequent online distribution of a live performance in a cultural venue (Elsden et al., 2022). If lockdown restrictions brought about hybrid cultural events by necessity, what comes next is the consideration of what hybrid-by-design might look like. How might ideas and contexts of hybridity, of multiple access points to events both in-person and online, synchronously and asynchronously, develop? What is the appetite for doing this work from the perspectives of both those who make, and those who consume, cultural events? Recent work by researcher and writer Katie Hawthorne explores contested definitions of liveness in performance, set against liveness viewed in the context of digital media. Through these two lenses, Hawthorne develops three key terms – digital distribution, digital mediation, and digital location – to describe ideas of liveness. Digital distribution centres on documentation and sharing of performance, digital mediation places digital tools in between interactions between audiences and performers, and digital location is applies to performances that happen in a digital rather than physical space (Hawthorne, 2022). These definitions begin the process of understanding the conditions through which digital liveness might grow and develop post-pandemic.

At *Future Culture Edinburgh* in September 2021 (Jones and Cunningham, 2022), workshop activities found that digital technologies and events were

not a key focus for developing more equitable cultural structures amongst participants. In conducting the preliminary research interviews for further work envisioning digital and data-driven festival futures in late 2021-early 2022, Creative Informatics researchers encountered mixed feelings among those working in and around festivals in the region about the potential for future development of digital and hybrid events and approaches. Some felt excited by the accelerated adoption of technologies in both the production and consumption of cultural events and were actively working to continue to develop their practice in this area. These participants ranged from festival organisers who saw opportunities in digital development and online practice in areas of equity of access and audience development to those whose work focused on developing digital and online performances and platforms for supporting and distributing them. Others were much more focused on a return to pre-pandemic models, particularly if their organisations or practice had not previously included much allocation of resource for digital work beyond seasonal marketing support. Across this spectrum of experience, many participants noted that the economic case for investing in digital technologies as part of live event programmes was difficult to make in the immediate aftermath of COVID-19 restrictions and has become more so in the face of global economic challenges.

As well as the need for a financial case for digital and data-driven live event programming, the concept of 'liveness' and the notion of shared experiences, rituals, and codes (Piccio et al., 2022; Elsden et al., 2022) that accompany attending a festival event or performance were key points of discussion both in the height of lockdown restrictions in 2020 and thereafter. In conducting research into experiences of the 2020 Edinburgh Festival Fringe, Creative Informatics researchers recommended a focus for future development for online and digital festivals by preserving opportunities for social interaction with and amongst festival audiences in a situation where digital access might be seen to impede or fragment a sense of collective audience experience. Liveness, they found, was captured in "an immediate and tangible chemistry between the audience and the actors on stage" (Piccio et al., 2022, p. 5) which cannot be entirely replicated in events that take place across times and spaces, mediated by multiple platforms and devices. In this sense, online events at the 2020 Edinburgh Festival Fringe were very often felt to be lacking through the absence of a recreation of an in-person audience's "full experience journey" (Piccio et al., 2022, p. 9). As such, the idea of 'liveness' itself also became ritualised as the expectation of performances and live events that would be the most difficult for any digital representation to meet.

Digital and data literacies in live events and festivals

Where digital adaptations came about because of the cancellation of live versions of events, it is easy to understand why these could be viewed as 'less

than' a live, face-to-face experience. But, as already noted, where these adaptations were the only option for already engaged cultural audiences, they were supported, even if they did not necessarily fulfil the promise of reaching large numbers of new audiences (Walmsley et al., 2022). However, as intersecting conditions and definitions of digital liveness (Hawthorne, 2022) show, the influence of digital technologies over live performances and events is more complicated than a live/digital binary. Before, during, and since COVID-19 restrictions, liveness and the audience experience that surrounds it have been mediated, moderated, and enhanced by digital technologies.

When the first COVID-19 lockdown was announced, programmes like the National Theatre's NT Live[10] – which screens optimised, high-quality recordings of live theatre performances in cinemas – had a pre-existing model that could be adapted for at-home viewing during the pandemic. Those Edinburgh Festival Fringe artists interviewed by Creative Informatics researchers in 2020, however, had no such archive or material and often no access to recording equipment that might produce engaging recordings of full-length performances. Instead, the research found that artists looked to other ways to generate value from live online performances and recordings and their distribution, and began to develop new skills and literacies to approach that work (Elsden et al., 2022). For those artists, rather than attempting to compete with whole event recordings that were able to create an experience very close to in-person liveness – or at least one that could compete with the production values of familiar streaming services – they experimented with technologies, formats, and platforms for performance that went beyond replicating liveness towards creating new modalities of digital experience. In doing so, these forms of online content did not set out to devalue live performance but to explore new forms of liveness within the parameters of their artforms, digital skills, and access to online audiences.

The rapid growth of some previously little-known platforms – perhaps most notably the video calling and streaming platform Zoom – provided new performance opportunities. Rather than exposing artists and producers to brand new digital tools, skills, and formats, the pandemic could be seen as having forced a recalibration of the perceived value of digital experiences within the broader context of producing and consuming live events. The mediation of liveness through digital platforms was happening pre-pandemic – from the targeted audience interactions that are enacted through digital marketing and social media (Miles, 2018; Noehrer et al., 2021), and reaching new and broader audiences (The Audience Agency, 2019; DCMS, 2018) to box offices, ticketing, and access to reviews by audiences as well as by critics. At a general level, what happened in 2020 and 2021 was that the impact of the pandemic accelerated, or shifted, the configuration and value of digital approaches, rather than brought them about (DDCMS and AHRC, 2021), at least within those organisations with pre-existing skills and digital presence best placed to make that shift (Walmsley et al., 2022). This is not

just the case for audience reception of live events, but for the cultural workforces that produce, market, and deliver them too.

The findings from Creative Informatics' 2020 research show how quickly adaptations and new forms of digital work were created in response to the cancellation of the Edinburgh Festival Fringe. Another piece of Creative Informatics' research, Improvbot,[11] demonstrates how those working in and around the festivals sector who had the resources to do so were able to use the time afforded by the cancellation to explore pre-existing projects playfully and in ways that would not have happened during a 'normal' festival run (Terras et al., 2021). This practice-based digital research project used 28 million words of text from Edinburgh Festival Fringe show listings from 2011 to 2019 to train an AI neural network to produce AI-generated event listings for a fictional virtual festival of performance and comedy. Multiple listings were posted daily on Twitter throughout what would have been the dates of the 2020 Fringe. And, each evening, the University of Edinburgh Theatre Company's improvisation group – the Improverts[12] – responded to some of the listings to create a one-off Fringe cabaret performance, hosted online. While deliberately designed to bring some lightness to the unease of our collective experience of COVID-19 lockdowns and the exposed precarity of artists who were no longer able to present their work at the Fringe that accompanied it, Improvbot also surfaced challenges around tensions between human creativity and artificial intelligence in creative work that have grown and developed since 2020. In creating an AI-generated festival, happening in and led by machines, Improvbot was also impactful through its highlighting of the material parts of the 2020 Fringe that were not happening that year – performances, but also the printed Fringe brochure, as noted by a review in The Stage whose writer experienced:

> unexpected nostalgia for leafing through the last-minute word salads contained within the pages of the Fringe brochure. After all, the perfect storm of virus transmission and technological advances leaves us wondering whether we'll ever see that publication again.
>
> *(Pollock, 2020)*

The sense of a recalibration of relationships between the digital and the live during the pandemic was very much at the heart of the development of the research questions and themes that informed the speculative, participatory futuring methods (Kozubaev et al., 2020; Ramos et al., 2019) of the research that became *FestForward Magazine* (see case study). This project sought to bring together research into digital responses to the pandemic and the focus on inequities of access to cultural jobs and experiences that the pause of live events during lockdowns brought about. By asking participants working in the cultural events and festivals sector to envision digital and data-driven

festival futures in 2030, the goal was to explore possible and preferable futures without dwelling too long in the complexities and challenges of the present. But a near-future scenario also gave space for reflection on what had passed. To explore and envision these digital futures, Creative Informatics researchers identified four themes through which to develop participatory work with the live events and festivals sector. These were the uses and value of data from and for festivals, artists, performances, and audiences; cultural work and platform labour – considering the shifting mediations of live and digital both on stage and off; producing and experiencing live performance; and new creative transactions – exploring alternative payment and distribution models for live events mediated through digital technologies.

The case study accompanying this chapter explains the process of conducting the participatory research that produced *FestForward Magazine*. But these themes were employed first by the research team to produce a series of speculative artefacts called 'provotypes'. These were used in participatory sessions with festivals sector workers to evoke possible futures around digital technologies and data and their potential role in equitable and sustainable festival futures. At online and in-person workshops organised according to these themes, the provotypes acted as prompts to frame discussions and activities where participants became *FestForward* journalists and wrote headlines about their responses to the near-future scenario provided. Through participatory futuring and speculative design methods (Kozubaev et al., 2020), the provotypes successfully supported positive conversations about possible and preferable futures that were also sensitive to the complex economic, social, political, and cultural challenges the sector had faced.

By bringing ideas of equitable and sustainable festival futures together with digital technologies and data-driven innovation, the research sought to explore new framings and perspectives on the ongoing and developing role of data, platforms, digital media, and modes of performing liveness for festivals and cultural events. In 2021, when live events began to return to the Edinburgh and southeast Scotland region, local research at the time, including *Future Culture Edinburgh* (Jones and Cunningham, 2022), indicated that exploring and imagining these ideas and actionable futures was difficult and complex. Furthermore, when challenges were identified, they were often interconnected with external policies and practices making them hard to address unilaterally. This was extenuated by the contemporary landscape of social and economic precarity and inequities of access to careers in the cultural sector (Brook et al., 2020) that the pandemic had further exposed and that could understandably make cultural organisations, artists, and producers more risk averse. In addition, some of the lack of interest in and focus on seemingly positive developments brought about through digital developments could be quickly surpassed by a reported need for in-person human connection through festivals and events.[13] A nostalgic take on the need for,

and specificities of, liveness was also found to have led to an outright rejection of forms and formats of festival production and distribution that might deviate from the opportunity to return to 'normal.'

In interviewing participants to inform the process of making *FestForward*, barriers to continuing to develop work on digital, online, and hybrid events programmes very often included high costs and difficulties in monetising these events, as well as a lack of resources, skills, and literacies to fund digital cultural work that went beyond digital and social media marketing. As a result of the challenges of economic, structural, and skills support, across the spectrum of organisations, funders, and artists, the research found a directly and indirectly reported lack of appetite for further development. But with our lives and our consumption of culture continuing to become more and more mediated by and through digital technologies and platforms, part of the mood that *FestForward* captured was also about a bigger conversation about the role of technologies, platforms, and data in cultural production and consumption more broadly, and how to develop new funding and business models that extend further than just generating economic value and revenues from culture and creative work. This near futures focus allowed the project to explore not only how these technologies help to produce and mediate festivals and events but the idea of a festival itself as a platform through which to think about, develop, and promote ideas of agency, equity, sustainability, and power in making and accessing these events (Mair and Smith, 2021) and to make a case for the development of economic, social, and cultural conditions through which to build a connection between digital technologies and data for broadening and deepening access.

Exploring place in the context of digital and hybrid events

As already noted, the city of Edinburgh as a cultural destination is synonymous with arts festivals, particularly those that take place during the city centre in August, when the Edinburgh Festival Fringe is just one of a group represented by the strategic organisation, Festivals Edinburgh, that includes the Edinburgh International Festival, Edinburgh Art Festival, Edinburgh International Film Festival, Edinburgh International Book Festival, and the Royal Edinburgh Military Tattoo.[14] In August, Edinburgh becomes a city which can be 'done', a 'Festival' which creates a public-facing collective of what is in fact several independent cultural organisations. This imagined 'Edinburgh' fulfils a particular function for festival audiences – those who live in the city and its visitors – but also for the city and its year-round cultural life and infrastructure, with its 'world-leading' tag line also generating impacts for tourism and for other festivals in the region that are not able to, or do not want to, operate on that register or at that scale and who work to different models that they feel best serve their region and audiences. 2022 figures produced by Festivals Edinburgh report 3.2 million festival attendances,

generated by 700,000 attendees,[15] while the city's population was recorded as just over 526,000 in the same year.[16]

The Edinburgh cultural imaginary, as we have termed it, generates economic value for the city – its economic impact was recorded in 2015 as being £280 million for Edinburgh and £313 million for Scotland and updated in 2022 as £407 million for Edinburgh and £367 million for Scotland.[17] But the city as a cultural destination is also connected to the year-round social, political, and cultural values of the place. In fact, the post-war founding of many of Edinburgh festivals, alongside the 1946 founding of the Scottish Tourist Board, put culture at the heart of the UK's post-war recovery through the chance to focus on our value and values while also positioning culture as an "economic tool" (Bartie, 2013, p. 2). Festivals are very much embedded in the structures of the Edinburgh imaginary, and in the city's modern cultural and architectural history, so it is easy to see how the disruption and cancellation of live events in Edinburgh specifically were extremely unsettling for those working in the city's cultural sector. Attempts made by festivals in 2020, in Edinburgh and in the rest of the region, can be seen – as supported by Creative Informatics' Fringe 2020 research – as responses that experiment with ideas of digital placemaking, festivals as platforms (in both their online and in-person programmes), and the opportunities for multiple points of access that digital and online presentations can bring, including the potential for exploring digital modalities as means of generating economic benefits for the city.

Despite some calls for a swift return to pre-pandemic 'normality', research in the Edinburgh and southeast Scotland region as we emerged from lockdown restrictions, including the case study research incorporated here, began to explore the relationship between notions of place and digital technologies, skills, and datasets. These findings broadly correspond with Rentschler and Lee's three themes for transformations of arts festival places in South Australia – the balance between local and international focus, the need for multi-organisation collaboration, and a shift towards digital approaches (Rentschler and Lee, 2021). The report from *Future Culture Edinburgh* (Jones and Cunningham, 2022) found tensions around the balance between Edinburgh's international outlook and reputation as a cultural destination and the city's cultural relationships with its residents and communities. This may in part be a reaction to the adaptations made by some cultural organisations during lockdowns, where their work was adapted to direct support for their immediate communities, including digital support (Jones et al., 2020),[18] as well as concerns around environmental sustainability impacts of bringing international artists to Scotland. While the Festivals Edinburgh[19] cultural destination umbrella signals collaboration between some of the city's festivals, the provotypes and imaginaries developed through Creative Informatics' Creative Horizon research puts forward futures-focused developments that might further embed shared working between festivals in Edinburgh and

further afield. From the envisioning of a Scottish Festivals Data Cooperative and the creation of a new job of a data custodian for festivals to a festivals currency that rewards support for local creative and experience economies, *FestForward Magazine* begins what could become a lasting exploration of ways in which digital placemaking can support and enhance new constructions of cultural places that incorporate both physical and digital environments and platforms and social, cultural, and economic benefits.

Envisioning equitable and sustainable digital futures for cultural industries

All the case study research projects included in this chapter have, in diverse ways, explored both present and future concerns in the sustainability of live events and festivals. As such, we can start to think about how the envisioning of possible and preferable futures can play a role in developing equitable and sustainable cultural sector infrastructures and ecosystems, with an increased focus on digital technologies – in Edinburgh and southeast Scotland, the UK, and further afield.

In 2020, Creative Informatics' research with Edinburgh Festival Fringe artists and producers showed that the speed and necessity of the 'pivot to digital' they had undertaken had challenged assumptions about digital approaches and live performance; encouraged experimentation; and changed, if only temporarily, the expectations and access points for both artists and audiences. The research made recommendations for artists in areas such as: continuing to develop digital stagecraft and ideas of liveness that capture a sense of being present in a social space, using recorded content strategically to expand the impact of recorded work; continuing to explore new approaches to ticketing and monetisation of digital performance; and recognising the potential of digital performance for access and inclusion; as well as for more sustainable approaches to international collaborations and touring. For festivals, in-person venues, and organisations, the research recommendations overlapped with those made for artists, but also included adapting organisational structures to accommodate digital roles and responsibilities, supporting audiences to navigate online content, supporting diverse forms of performance and performance content, and considering new forms of value of live events that learn from the issues of scarcity and liveness which 2020's Fringe programmes began to explore.

In bringing these three case studies together, however, the hybrid symposium event *Future Culture Edinburgh*, which took place in September 2021, shows a somewhat different picture to research in 2020 around digital and online adaptations to live events. When asked to think about parts of Edinburgh's cultural ecosystem that they would like to keep, lose, and change, participants – who were composed mostly of those who worked or had a keen interest in the city's cultural sector – did refer to the potential of digital

technologies and data-driven innovation. But, in a workshop activity looking at areas and ideas for future development, digital adaptations were not central to any of the options the group chose to document and explore. This finding, as the *Future Culture Edinburgh* report (Jones and Cunningham, 2022) suggests, could imply that the link between digital technologies and data and equitable and sustainable futures was not a well-developed connection for the sector at that time. But the report also notes that this lack of connection could be the result of a preoccupation with a return to 'normality' and in-person events after a reduced festivals programme that summer.

In surveying research in this space with lockdowns further behind us, it is easier to see that the lasting impacts and resilience of digital adaptations from 2020 and 2021 remain difficult to determine. As shown in the introduction, some of the imagined promise of digital technologies and programmes for allowing cultural programmes to reach new audiences was not found to have been borne out in audience data. Instead, those that accessed online programmes from established cultural institutions during lockdown were found to be predominantly the same people who had accessed similar activities in-person before the pandemic (Walmsley et al., 2022). In addition, economic challenges for cultural events and venues have meant that many are no longer able to continue to programme synchronous hybrid events or to make time and space for exploring and developing new approaches to platforms for performance, recorded content, or data-driven cultural work. Audience behaviours are also changing, as noted by the Audience Agency's Cultural Participation Monitor,[20] a UK-wide longitudinal survey which began in 2020 and records audiences' views on cultural participation. Findings released in summer 2023 show economic concerns and rising cost of living as being a key driver of declining attendance, which is lower than before the pandemic, but that decision making about attendance was also associated with audience expectations around cultural organisations' public articulation of their social and environmental values. While those surveyed expressed a strong preference for live cultural experiences, this was accompanied by preferences around more relaxed approaches to audience conventions and behaviours, for example, eating, drinking, and taking photographs.[21]

In this context, Creative Informatics' research has shifted its focus and stepped back from immediate challenges to begin to consider how to have complex conversations about digital futures for live events, particularly in the context of economic precarity and known inequities of access to cultural production and consumption. For research participants, these imaginaries acted as hooks on which to hang discussions that incorporate contemporary ideas, opportunities, and challenges while playfully imagining diverse future outcomes. In addition, as a speculative artefact, *FestForward Magazine* continues to act as a tool for discussion and for creatively imagining preferable futures – for those who make and consume live experiences – but also as a

way of sharing their experiences with funders and policymakers with a view to redesigning creative economies to be more equitable and sustainable.

Research commissioned by the Creative Industries Policy and Evidence Centre (PEC)[22] and Bristol (UK)-based UKRI-funded funded project MyWorld[23] entitled *The Networked Shift: A Creative Industries Foresight Study* (Coldicutt et al., 2023) used Bill Sharpe's Three Horizons Model (2019)[24] to explore futures for the UK's creative industries. In this use of the model, Horizon 1 represents 'business as usual' and the way things are done now; Horizon 3 is the path which becomes the long-term replacement for the ways of doing things that were previously the case in Horizon 1. Between these two paths is Horizon 2, which represents the more incremental innovations and things that happen that allow Horizon 1 to be superseded by Horizon 3 (Coldicutt et al., 2023). Through interviews and workshops, Coldicutt et al.'s research identified preoccupations for the UK's creative industries, which were further narrowed to three interconnected 'sticking points' – defined as "clusters of social, economic and technical conditions" (Coldicutt et al., 2023, p. 4) – that can be either enabling or inhibiting change. The first, 'The Opportunity Contradiction', shows that the democratisation of access to production and distribution brought about by digital technologies and platforms is not reflected in the demographics of the creative industries workforce (Brook et al., 2020), which inhibits change through a sense of unresolved tension between the expectation of opportunity and the challenge of initiating that reality. The second explores the impact of automation on the creative industries, including the ethical and human challenges that may arise. The position of the creative industries to meet these challenges and embrace opportunities may vary as a result of social and economic situations, but the impact of hype, and the expectation of speed of development, have the potential to create and reinforce what the research terms a "high tech vs low tech" divide and preoccupation (Coldicutt et al., 2023, p. 12). The third sticking point considers 'Platform Dependency in a Post-Lockdown World' and notes the difficulties of data-driven decision making in a world which is still recalibrating post-pandemic, as well as the frequent disconnect between agile commercial platform businesses' capacity to change and that of the creative industries. When platforms set a different, and faster, pace, this can inhibit sustainable change for creative businesses and may cause them to miss opportunities to address inequities and prioritise sustainability and resilience (Coldicutt et al., 2023).

In examining these three sticking points, Coldicutt et al. capture some of the complexity of the interconnecting social, cultural, economic, and human challenges discussed here in relation to digital technologies and live events. There are notable intersections between these three sticking points and the themes through which Creative Informatics researchers explored digital festival futures in making *FestForward Magazine* – uses and value of

data, producing and experiencing events, cultural work and platform labour, and new creative transactions. In addition, Coldicutt et al. use their findings around this complex network of digital practices with the potential for change or changemaking to propose an additional Horizon 3 for this version of Sharpe's model. This horizon also gives the report its title, *The Networked Shift*, and predicts the growth of new practices through many and varied connections, often informal, that they predict will give rise to a "digital-by-default networked set of practices" (Coldicutt et al., 2023, p. 32) that will bring about digital transformation.

Again, it is interesting to map findings from *The Networked Shift* against the opportunities and challenges envisioned through Creative Informatics' participatory futuring research, which combined research-led, grassroots-led, and design-led approaches to build scenarios and worlds with and alongside participants to explore how these might look and feel. This work gave rise to several imaginaries across the four research themes outlined previously that support the idea that these networked practices might happen outside of traditional cultural institutions and festivals. The provotypes and magazine headlines created through the project and featured in *FestForward* include several cross-cutting and networked ideas: from a Cultural Platform Labourers' Union and its organised strike action to a Scottish Festivals Data Cooperative; and from a Sustainable Innovation Award-winning festival currency, Fe$toons to responses to the closure of previously dominant online platforms. While designed as fictional examples, the creation of these provotypes are suggestive of what has been termed the moral economy of cultural work (Banks, 2006). In attempting to both study and create the conditions for change, all the research this chapter examines – but particularly the fictionalised 'editorial' role of the research team in *FestForward Magazine* – uses the time and resources afforded to researchers to take the privileged position of undertaking futures-focused work.[25] That is not to say, however, that the perceived precarity and complexity of the situation and challenges of those working in the cultural and festivals sector, as well as the creative industries more broadly, prevents changemaking through the practice of cultural work. Part of the role of research that focuses on the envisioning of possible and preferable futures is that it could be part of the social, cultural, economic, and political approaches that might facilitate the development of the moral economy and bring those imagined futures about. This could take the form of experimenting with new funding structures and business models to support digital and data-driven innovation in live events and cultural industries; supporting networks of creative workers to exchange knowledge and ideas to create and communicate shared value propositions around equity, sustainability, and digital technologies; and making a case for cultural places that learn from the concepts of live events as platforms, digital distribution, and new modalities of presentation and performance to support equitable and sustainable cultural events.

Conclusion

As *The Networked Shift* report points out, the creative industries, and the live cultural events and festivals sector, may not yet be able to make data-driven decisions about changemaking in the aftermath of the COVID-19 pandemic. We do not yet know what, if any, lasting impact the rapid digital transformations enacted by live performers in 2020, as captured by Creative Informatics' work with Edinburgh Festival Fringe participants, will have. The Centre for Cultural Value's *Culture in Crisis* report shows that digital cultural events programmes during lockdown did not attract new audiences, but did open conversations about access to digital cultural experiences for broader demographics than organisations might have been expected to reach before. The ideas captured at *Future Culture Edinburgh* in 2021 are also reflections of continued pandemic uncertainty, alongside a clear appetite for change, but also a nostalgia for 'normality.'

For now, the lasting impact of the cultural sector's pandemic 'pivot to digital' might only be the fact that we know that it happened, and so that it could happen again. But with that knowledge comes a sense of an increased awareness of and interest in digital technologies, data-driven innovation, and hybrid and digital approaches in connection with live events and festivals. As the body of research discussed here shows, there are diverse ways to collaborate with cultural and creative professionals and practitioners to explore possible and preferable, and importantly more equitable and sustainable futures, that have the power to influence decision-making in the present, even with a social, cultural, economic, and political background of continuing challenges and uncertainty. The 'networked shift', the hype of AI, and the continued dominance of commercial digital platforms are all discussion points which are likely to continue to develop new modalities of experience beyond the pandemic. The positioning of these conversations, through the creative industries themselves and through research, in the context of new framings of creative economies – to include moral economies and ethics of care approaches to cultural work – will allow the conversation about the role of data, platforms, digital media, and modes of performing liveness to continue to balance the complexities of equitable and sustainable approaches and programmes with digital innovation.

Notes

1 https://www.culturehive.co.uk/wp-content/uploads/2022/01/Culture_in_Crisis.pdf (Walmsley et al., 2022).
2 https://www.edinburghfestivalcity.com/the-city
3 https://zenodo.org/record/4775363
4 https://efi.ed.ac.uk/future-culture-edinburgh/
5 https://zenodo.org/record/6037499
6 https://creativeinformatics.org/creative-horizon-projects/
7 https://www.studioandthen.com

8 https://www.festforward.org
9 https://www.nationaltheatre.org.uk
10 https://www.ntlive.com
11 https://improvbot.ai with more information about the project in a Creative Informatics research blog from August 2020 at https://creativeinformatics.org/research/improvbot-and-practice-based-digital-research/
12 https://www.bedlamtheatre.co.uk/shows/improverts
13 See for example an article by Edinburgh-based culture writer Arusa Qureshi https://www.timeout.com/news/the-edinburgh-fringe-is-back-but-what-do-the-locals-think-071122, which looks at Edinburgh's perceptions of a return to a larger in person programme in August.
14 https://www.edinburghfestivalcity.com/#festivals
15 https://www.edinburghfestivalcity.com/news/1660-unique-edinburgh-festivals-programmes-strengthen-recovery
16 https://www.edinburgh.gov.uk/downloads/file/30669/edinburgh-by-numbers-2022
17 Taken from key findings from the Executive Summary of Edinburgh Festivals 2015 Impact Study, produced by BOP Consulting and commissioned by Festivals Edinburgh, https://www.edinburghfestivalcity.com/assets/000/001/964/Edinburgh_Festivals_-_2015_Impact_Study_Final_Report_original.pdf?1469537463, p. 1 Updated impact figures from the summary of the 2022 Impact Study, https://www.edinburghfestivalcity.com/assets/000/005/534/Edinburgh_Festivals_Impact_Study__digital__original.pdf?1687855168. This report notes that the "increase in net aggregate economic impact for 2022 was greater for Edinburgh than for Scotland in part because of more spending from Scottish 'staycation' audiences, contributing to larger additionality of audience spending in Edinburgh (82%) than in Scotland (64%)" (p. 2).
18 For an Edinburgh context, see the Edinburgh Culture and Communities Mapping Project's 2021 report, *Art in and Out of Lockdown*, which documents responses to the COVID-19 pandemic from eight Edinburgh-based community arts hubs https://www.edinburghculturalmap.org/research/art-in-out-of-lockdown-report/
19 Festivals Edinburgh is the "strategic umbrella organisation" that supports collaborative promotion of the city's festivals brand to "develop the value" of the festivals. See https://www.edinburghfestivalcity.com/about
20 https://www.theaudienceagency.org/evidence/cultural-participation-monitor
21 https://www.theaudienceagency.org/news/cultural-participation-monitor-findings-summer-2023
22 https://www.pec.ac.uk [Accessed 1 June 2023].
23 https://www.myworld-creates.com/ [Accessed 1 June 2023].
24 https://www.h3uni.org/tutorial/three-horizons/ [Accessed 1 June 2023].
25 See, for example, reflections from the Joseph Rowntree Foundation's Emerging Futures programme, written in April 2022, https://www.jrf.org.uk/blog/building-alternative-futures [Accessed 1 June 2023].

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CASE STUDY

Envisioning equitable and sustainable digital festival futures: *FestForward Magazine*

In August 2022, Creative Informatics published the output from its Creative Horizon 3 research project,[1] *FestForward Magazine*, (https://festforward.org) a fictional, speculative cultural magazine, which is envisioned as Scotland's leading cultural publication in 2030. At the heart of the project was the idea that the magazine and the methods used to make it offer a creative and engaging way to start conversations about possible and preferable festival futures – for festivals and those who work with them but also for policymakers, funders, and other academics in this space.

The magazine was developed by Creative Informatics researchers Vikki Jones, Chris Elsden, and Ingi Helgason and designed in partnership with Glasgow-based futures design researchers, Andthen.[2] All the content was based on interviews and workshops with people working in the festivals sector in the Edinburgh and southeast Scotland region, and explored the question of how digital technologies and data-driven innovation might support equitable and sustainable festivals in 2030.

The purpose of the project was to bring together two strands of work from existing Creative Informatics research – looking at ways to imagine equitable and sustainable festivals in the region and around new framings of digital and data-driven festivals and festival economies, particularly in the context of the impact of COVID-19 restrictions on live events.

Revisiting this work allowed the research team to establish four key themes for the project:

- The uses and value of data from and for festivals, artists, performances, and audiences.
- Cultural work and platform labour – considering the shifting mediations of live and digital both on stage and off.
- Producing and experiencing live performance.
- New creative transactions – exploring alternative payment and distribution models for live events mediated through digital technologies.

The research was planned around the idea of participatory futuring – designing spaces and outputs with people working in the sector – and speculative design methods (Kozubaev et al., 2020) – This approach facilitated the creation of speculative 2030 imaginaries of equitable and sustainable festivals and helped with the further development of these themes in the context of understanding participants' near future expectations for digital technologies and data-driven innovation.

The first stage involved semi-structured interviews with people working in the sector. From there, the research team and Andthen developed a series of 'provotypes' – near-future scenarios represented through visual storytelling and artefacts. From these provotypes, the team delivered a series of online and in-person workshops with people working in the festivals sector. On entering the workshop space, participants were given a new job as *FestForward* journalist and, inspired by our themed provotype scenarios, were asked to write headlines inspired by what they had seen and discuss their thoughts, hopes, fears, and challenges with one another. From here, the research team coded the headlines, reflected on the responses, and brought them together to write and design the content in the magazine.

Unsurprisingly, given the rapid developments taking place in creative digital technologies, some of the technologies envisioned in *FestForward* were very much in use within a year of its publication. Most prominently, the imagined AI-powered scriptwriting software – Culture.ai – dated quickly. At the time of writing, creative AI is quickly becoming a developing tool in the creative industries, as reflected in Creative Informatics' AHRC-funded Creative AI Demonstrator project, which explores the potential of AI – the opportunities, as well as the challenges.[3]

Other ideas developed in the magazine align with ongoing public conversations about data – what we are prepared to, or left with little option not to, give away, and the value we receive as a result. Or is there, and could there ever be, an algorithm that could account for the opportunity festivals offer to attend an event that is outside what you might usually choose? What data from other areas of your life would you be comfortable providing to a data-driven system to find it? These remain pertinent questions both for live events and festivals and for society more broadly.

Exploring the opportunities and value of data-driven innovation for the creative industries is at the heart of the Creative Informatics programme, and *FestForward* explores possibilities for the principles and practices of data collection, sharing, and analysis. Through the lens of cultural work, which is one of the key themes of this research, the magazine envisioned the role of an independent Festivals Data Custodian and considered the impact of a collaborative data-driven approach for festivals in the region.

By 2030, *FestForward* imagines, cultural work will become more and more mediated and performed through platforms. The magazine explores a 'day in the life' of a freelance festival platform worker, and a cultural influencer, to highlight the nature of platform work in the festivals and performance sector that, in a contemporary context, is perhaps more closely associated with other digital media. This imaginary extends to a collective response from workers to form the Cultural Platform Labourers Union, which tracks the working time and conditions of its members. Discussion of a planned strike in July and

August 2030 seeks to expose unequal opportunities and access to cultural work in the sector.

As Chapter 10 shows, digital technologies and data do not just support festivals and events, they are also ways to produce, present, and mediate performance. In a contemporary context, festival programmes have begun to return to formats and sizes that resemble pre-pandemic norms, and perhaps some of the expanded notions of the potential of digital and data-driven performances that COVID-19 lockdowns necessitated have been set aside. However, the near future scenarios laid out in *FestForward* imagine a steadier evolution of perceptions of the value of digital and hybrid performances in the run-up to 2030 that bring back more of these experiences, as well as new and nuanced concepts of digital liveness.

Vikki Jones

Case study notes

1 https://creativeinformatics.org/news/creative-horizon-3-envisioning-digital-futures-for-equitable-and-sustainable-festivals-in-2030/
2 https://www.studioandthen.com
3 See https://creativeinformatics.org/creative-ai-demonstrator-project/

11

DATA-DRIVEN INNOVATION FOR SUSTAINABLE PRACTICE IN THE CREATIVE ECONOMY

Ecological, social, and cultural aspects

Inge Panneels, Susan Lechelt, Alessandra Schmidt, and Aykut Coşkun

Abstract

Can data-driven innovation support the shift towards a more sustainable future? In this chapter, we present case studies from eight European cities to demonstrate how the creative sector is moving towards economic models that expand beyond the notions of growth alone and include ecological, social, and cultural benefits. Our focus is to highlight the opportunities and challenges for sustainable futures in the creative industries based on examples of data-driven innovation drawn from maker communities, small creative entrepreneurs, and creative organisations. Specifically, the case studies within this chapter highlight how creative, data-driven innovation processes can support 1) efforts to change patterns of ownership and consumption, 2) tools and training to support understanding of sustainability and 3) platforms for empowering sustainable and circular economy communities. Through this lens, we showcase some of the ways that the creative industries have used digital solutions to lead the way towards sustainable (and therefore social) innovation.

Introduction

The creative industries are integral to the production of new products and services and contribute to societal shifts in culture and innovation. Therefore, embedding sustainability in the creative industries is critical to a more sustainable, circular economy. Although culture is acknowledged as a key resource for mitigating and adapting to climate change (UNESCO, no date), it has not been mentioned in the latest Intergovernmental Panel for Climate

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Change (IPCC) Report (2022). Given this, adapting to climate change and transitioning towards a sustainable and circular economy requires a fundamental shift in how we live and do business. Yet the need for radical transformation is accepted to require not just technological change; but also requires social, cultural, and behavioural change as well as institutional and organisational change (Geels, 2005; Loorbach, 2010; Krupnik et al., 2022). This includes transformation of industries and institutions within a 'triangle of change' encompassing governments, consumers, and communities (Tukker et al., 2008, p. 1219). To be successful, this must include a cultural change (Light et al., 2019) to embed sustainability across all areas of public and private life. Cultural change, however, is not well understood, nor will it be easily achieved (Fazey et al., 2018).

In this chapter, we view (social) innovation, and data-driven innovation in particular, as contributing to sustainability not just from an economic perspective but also from environmental, cultural and societal perspectives, as embodied in the UN Sustainable Development Goals (SDGs) (UN, 2015). We argue that this multifaceted perspective on innovation could be used to support sustainability transformations in the creative economy. We pay close attention to how creative professionals, communities, and citizens embed sustainability in their practices and what role technology and data-driven innovation can have in supporting sustainability in the creative economy.

We demonstrate diverse ways in which data-driven innovation is helping creative businesses and organisations to become more sustainable and enabling them to support other communities to transition to sustainable practices. To do so, we present an analysis of case studies from two projects: Creative Informatics[1] in Edinburgh and the southeast of Scotland region and Pop-Machina,[2] composed of seven European cities: Leuven (Belgium), Venlo (The Netherlands), Istanbul (Turkey), Santander (Spain), Thessaloniki (Greece), Piraeus (Greece), and Kaunas (Lithuania). Together these projects illustrate how a wide range of creative businesses and organisations are exploring data-driven innovation to embed social, cultural, and environmental sustainability. Our analysis reveals that data-driven innovation can contribute to 1) efforts to change patterns of ownership and consumption; 2) tools and training to support understanding of sustainability; and 3) platforms for empowering sustainable and circular economy communities to connect, exchange, and learn.

This chapter presents insights into how data-driven innovation can support the decision making of creative professionals and communities by providing successful examples which can be transferred to other contexts and what challenges can hinder data-driven innovation's potential in contributing to sustainability transitions in the creative economy. We also demonstrate how enabling data-driven innovation in the creative economy is not straightforward and can carry a significant risk of failure. In summary, we demonstrate how data-driven innovation can be deployed to help both make

smarter and better decisions and to inform and support social innovation by connecting communities to work together towards more sustainable business practices. We contend that data-driven innovation is an under-resourced lever for social innovation in context of climate mitigation.

Framing

Here we outline what we mean by data-driven innovation in the creative economy and how this relates to sustainability and social innovation.

Cultural and creative economy

The creative industries (CIs) as defined by the UK government's Department for Digital, Culture, Media and Sport (DCMS) are "those industries which have their origin in individual creativity, skill and talent and which have the potential for wealth and job creation though the generation and exploitation of intellectual property" (DCMS, 2001, p. 5, 1998). This definition contrasts with the United Nations' definition of the creative economy at large (UN, 2008), which considers the interrelation between economic growth, employment, trade innovation and social cohesion. Critically, the UN takes a holistic approach, beyond economics, which includes cultural identities, economic aspirations, social disparities, and technological disadvantages. In this chapter, we take the UN's broader definition of the creative economy as the basis of our understanding, as the part of the economy that is "at the crossroads of the arts, business and technology" (UN, 2008, p. iii). This view aligns with our expansive understanding of sustainability outlined in the following.

Sustainability

The UN Sustainable Development Goals (SDGs) are the global governance blueprint "to achieve a better and more sustainable future for all" (UN, 2015) and take a holistic approach to human development (UN, 2019). Alternatives to the orthodox linear economic model of indefinite growth, such as those offered by circular economics (Ellen Macarthur Foundation) and doughnut economics (Raworth, 2017), contend that the current economic model is not compatible with 21st-century needs (McDonough and Braungart, 2002) and that metrics such as gross domestic product (GDP) are no longer fit for purpose. This builds on earlier work, notably Meadows et al. (1972, 1992, 2004), and the UN's *Our Common Future* (Brundlandt Report) (WCED, 1987), asserting that economic growth should meet 'the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987, p. 43). A circular economy argues for a systems solutions framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution. As such, a circular economy

needs to operate in the safe space for humanity that avoids human deprivation and safeguards ecological limits (Raworth, 2017). This perspective on the circular economy thus aligns closely with the SDGs.

These heterodox economic models require alternative business models. One extensively used definition of sustainability in business is the triple bottom line (TBL), proposed by Elkington (1994). It posits that businesses which pay attention to not only financial sustainability but also to their societal and environmental impact are more likely to thrive. Elkington argued that the TBL is a catalyst to move beyond the current economic paradigm and requires different responses from government and civil society. In line with the TBL, the Framework for Strategic Sustainable Development[3] (Robert et al., 2002) focuses on the economic, social, and environmental dimensions of sustainability. It is seen as a 'source-oriented' rather than an 'effect-oriented' paradigm, focusing on 'estimating what nature can tolerate and then setting standards for emissions and resource use' (Tukker et al., 2008, pp. 19, 25–26). Finally, the UN's 17 Sustainable Development Goals (UN, 2015) provides an expansive list of targets touching upon all dimensions of sustainability, as discussed previously. In this chapter, we use the SDGs as a lens to analyse the examples from the Creative Informatics and Pop-Machina projects.

Data-driven innovation

The first industrial revolution was characterised by steam powered mechanisation, the second by electrification, and the third by electronics and information technology (e.g., the internet). In the present day, the fourth industrial revolution is blurring the lines between the physical, digital, and biological worlds driven by technology and data (Schwab, 2016). Data-driven innovation (see book introduction) is the next evolution of innovation processes, enabled by ubiquitous digitisation, increasing access to data, and advances in machine learning, artificial intelligence (AI), and computing technologies (Luo, 2023). Data-driven innovation is powered by ('Big') Data and technology and is affecting almost every industry in every country at an exponential pace.

Data-driven innovation can contribute to both positive and negative sustainability outcomes for the creative economy. On the one hand, access to data can empower creative professionals to reflect on their own alignment with the UN SDGs, thus providing an opportunity to facilitate sustainability transitions in the creative economy. Conversely, using Big Data can increase the footprint of the creative economy. For example, data-driven fashion trend prediction can accelerate 'fast fashion' (Funnell, 2022), whereas some AI-based digital art can have a significant carbon footprint given that modelling large amounts of data for AI requires large amounts of energy (Jääskeläinen et al., 2022). As such, utilising data-driven innovation in the creative

economy requires reflection and criticality. Hence, it is crucial to explore both when data-driven innovation can support positive outcomes for sustainability in the creative economy (Lechelt et al., 2022) and when it exacerbates negative outcomes. In this respect, the concept of social innovation provides a relevant frame of reference.

Social innovation in the creative economy

Social innovation is described as the "agentic, relational, situated, and multilevel process" (van Wijk et al., 2019, p. 888) needed to develop and implement novel solutions to "wicked problems" (Churchman, 1967; Rittel and Webber, 1973) and produce profound change in institutional contexts. We refer to the concept of social innovation here in relation to the profound change required to shift to sustainable consumption and production (Tukker et al., 2008) as part of a circular economy. The 'three-cycle model of social innovation' (van Wijk et al., 2019) identifies the intrinsic dynamics of innovation and its innovators. At the micro level (first cycle), through reflexive interaction with other stakeholders, individuals (actors) can partially (or wholly) 'disembed' (van Wijk et al., 2019, p. 892) from governing institutional environments to create room for new perspectives to emerge. This innovation process is embedded and self-reflective, collaborative, and co-ordinated. At the meso level the actors then renegotiate existing patterns, structures, and beliefs to experiment with alternative proto-institutions (second cycle). The meso level connects to the macro level of institutional reform (third cycle), which is when innovation finally becomes embedded. This expanded view of innovation, which argues that social innovation is as much needed as technological innovation if a sustainable future is to be supported, underpins this chapter.

Our approach

We use the previous frameworks to demonstrate that data-driven innovation can provide tools to both support and evidence sustainability in the creative economy. Our case study approach was chosen to select specific examples from which we draw conclusions but does not seek to generalise across the creative economy.

The case studies were chosen from two large-scale creative economy R&D projects, which were financed through explicit research and innovation funding programmes: Creative Informatics was an outcome of the UK Government's Industrial Strategy (2017), and Pop-Machina was funded by EU Horizon 2020. Creative Informatics had an explicit focus on data-driven innovation, whilst Pop-Machina sought to reinforce links between maker movements and the circular economy. For both projects, we use the lens of data-driven innovation to examine sustainability.

We ask the following questions in our analysis of the case studies:

1. Do the projects utilise different data types (citizen driven, community driven, policy driven) to contribute to social and environmentally sustainable innovation in the creative industries?
2. Which Sustainable Development Goals are involved? We particularly focus on SDG 11: sustainable cities and communities and SDG 12: responsible consumption and production as the two key SDGs. However, we also note that SDG 9: industry, innovation and infrastructure and SDG 8: decent work and economic work are relevant to the examples. Finally, the more generic SDG 13: climate action and SDG 17: partnerships for the goals, are also implicit in the examples presented.
3. How do these projects create social change and transformation outcomes?

Case studies: data-driven innovation from Creative Informatics and Pop-Machina

Creative Informatics

Creative Informatics (CI) was a five-year (2018–2023) programme that supported data-driven innovation across the creative industries in Edinburgh and the southeast Scotland region. CI provided funding and support towards R&D activities for new 'data-driven' products and services to more than 350 creative practitioners, businesses, and creative and cultural organisations (see also Chapter 2). To be considered for funding, projects were asked to make use of data and data-driven innovation towards the development of new business models, access to new markets or audiences, the development of new audience/user experiences, or to support new insights. Whilst 'sustainability' was not a criterion for securing support and funding, a range of the funded projects have in fact engaged with sustainability in a diversity of ways (Lechelt et al., 2022). The *Creative Informatics Catalogue First Report* (2018–2020) (Elsden et al., 2021) was used as an initial method of selecting case studies (Lechelt et al., 2022) and applied a methodical coding approach, with affinity mapping and thematic analysis of 44 CI-funded projects. Subsequent funded projects were selected using the same parameters and coding methods (2020–2022). This was augmented with in depth semi-structured interviews with key partners.

This chapter provides examples of three CI projects: Custom Loop, an app to support bespoke knitwear production; Climate Friendly Culture, a system to support creative businesses in making environmentally sustainable choices; and Creative Cred, a project that explored how creative practitioners might be rewarded for embedding circular economy principles in their work through an alternative currency. Following this chapter, we also provide a

more in-depth case study of the Edinburgh Tool Library, which details how R&D funding supported the development of a calculator tool to evidence the carbon saved by borrowing rather than purchasing a tool.

Pop-Machina

The four-year Pop-Machina Horizon 2020 project (2019–2023) aimed to promote environmental sustainability and generate socio-economic benefits in a diversity of cities by strengthening the connections between the maker movement and the circular economy. One key objective was to support the growth of makerspace ecosystems and the production of circular innovations in European cities. Pop-Machina focused on makers and makerspaces: community-led, open access spaces where individuals share resources and collaboratively engage in creative commons-oriented projects, utilising open-source software and hardware technologies. Makerspaces, which are also commonly known as micro factories, hackerspaces, fab labs, or media labs, and others (Gandini, 2015) embody a sharing-economy model through an open (and often free) distribution of knowledge, tools, facilities, infrastructure, methods, and ideas. Thanks to this community focus, the makerspace movement supports the democratisation of skills as well as social inclusion (Metta and Bachus, 2020). Pop-Machina highlighted, embedded, and reinforced the links between the maker movement and the circular economy via a European-wide network of makerspaces. To achieve this goal, the project pioneered the establishment of 'circular makerspaces' (Prendeville et al., 2017) in seven pilot cities. It also developed three digital platforms, namely Open Knowledge Tool,[4] Social Collaboration Platform,[5] and Data Collection Tool[6] to further support the collaboration among makers and makerspaces and monitor circular making activities in Pop-Machina pilot cities. Furthermore, Pop-Machina also developed Local Future Stories[7] to support the co-design process of makerspaces which spoke to each location's local values associated with circular making. In this chapter, we present how these digital tools and Local Future Stories were utilised by Pop-Machina makers and makerspaces to drive circular making activities in the pilot cities.

Thematic examples

The following examples have been implemented and developed to different levels of fidelity; not all projects are complete or ready to be used in practice. However, all represent conceptual innovation in the domain of sustainability. The examples demonstrate three themes of data-driven-supported sustainability in the creative economy: 1) efforts to change patterns of ownership and consumption; 2) tools and training to support understanding of sustainability; and 3) platforms for empowering sustainable and circular economy

communities to connect, exchange, and learn. Through this lens, we reflect on what each project tells us about the use of data-driven innovation to support sustainability in the creative economy.

Theme 1: efforts to change patterns of ownership and consumption

It has been argued that the goal of reducing environmental pressures by challenging and changing patterns of consumption can be supported through three different avenues (Tukker et al., 2008): 1) greening production and products; 2) shifting demand to low-impact consumption (McDonough and Braungart, 2002); and finally 3) lowering material demand by reducing consumption, made more explicit in degrowth (Hickel, 2020). The examples that follow demonstrate how data-driven innovation can support efficiency and customisation in production to support more sustainable consumption.

Custom Loop

With the support of Creative Informatics funding, designer Jeni Allison used her extensive knowledge of the knitwear industry to develop an app, Custom Loop, for consumers to customise and order knitwear. The goal of the app is to advance a new 'slow' (Honoré, 2004) manufacturing model for knitwear, where only one garment is produced on demand: a direct antithesis to the bulk production that underlies fast fashion. This idea was enabled by the coupling of data-driven innovation and Allison's deep knowledge of the knitwear industry. Throughout her career, Allison observed that it is difficult and costly to develop knitwear samples and small production runs because of the high upfront cost. In developing Custom Loop, Allison decided to rethink and modify the traditional model of manufacturing to enable more sustainable, small-scale production, without increasing cost. To do so, she developed an app that provides 'guardrails' which enable users to adjust the design of a knitwear piece (e.g., a scarf or blanket) by moving and scaling 'data assets' (shapes, colour, initials, and others) which fit the parameters of industrial knitting machines on a digital canvas. The fact that the knit can be customised through a predetermined set of data assets means that the programming (and cost to) manufacturer is not substantially changed, but the appearance of the knit is. By enabling garment customisation, Allison also hopes to support owners' attachment to their garments, with the goal of extending the lifespan of the manufactured products.

Pop-Machina Social Collaboration Tool

One of the main objectives of Pop-Machina had been to engage citizens as circular makers, that is, by supporting individuals to perform reuse, repair, recycling, or refurbishing instead of disposing and purchasing. To support

this, Pop-Machina developed the Social Collaboration Tool[8] intended to provide an opportunity for makers (and citizens) to collaborate on circular making projects digitally. Once established, makerspaces in each Pop-Machina city were registered to the Social Collaboration Tool. Makers who joined were able to exchange or share knowledge, skills, tools, and products. For example, a maker in Istanbul hoping to repair a chair could use a digital model of a plastic part shared by a maker in Leuven.

The novel aspect of the tool from a sustainability perspective is that it not only focused on consumers as end users, but it targeted existing consumption and production practices of makers, as well as citizens aspiring to be makers. The tool allows makers to record their projects by adding data about materials, parts, and components. These projects can be shared via the platform with other makers who are interested in replicating them. Alternatively, makers can request support from other makers and makerspaces (e.g., material, equipment use, 3D models, etc.) to finalise their projects. In other words, the tool serves as a site for both data collection and collaboration for makers and citizens, supporting alternative modes of production and consumption for both parties. That being said, the execution of the Social Collaboration Tool in the Pop-Machina project helped reveal two main challenges. First, due to COVID-19, the opening of Pop-Machina makerspaces was delayed, in turn delaying makers' registration to the tool. This meant that within the duration of the Pop-Machina project, makers did not have many opportunities to exchange with others across geographies. However, the Social Collaboration Tool enabled particularly local ecosystems of makerspaces to connect, exchange, and share. The second challenge was that the makers involved often preferred to adhere to their own techniques of recording data about the materials, parts, and components required to produce an artefact (commonly called the Bill of Materials in the maker movement) rather than using the Social Collaboration Tool. This is because they perceived the Social Collaboration Tool as too complex and instead chose to record this information through, for example, Excel spreadsheets, because of their familiarity with these tools.

Theme 2: tools to support understanding of sustainability

One way in which data-driven tools can help citizens and consumers understand their environmental impact is by calculating carbon footprints. The process of calculating a footprint often highlights structural inequalities, with much data incomplete or non-existent and sometimes only being available behind paywalls thus making it inaccessible for small and medium-sized enterprises (SMEs) or requiring a high threshold of data literacy not afforded to most. It also highlights problems in the ability to collect data in a coherent, transparent manner that does not demand too much time or effort. Data-driven innovation can help to navigate these complex challenges but requires

intuitive interfaces and easy-to-use tools. The examples presented within this theme attest to how developing effective tools and technologies for supporting understandings of sustainability requires a deep understanding of the specific needs, values, and challenges of the intended audience.

Climate Friendly Culture

Climate Friendly Culture was a prototyped tool[9] funded by Creative Informatics that supports cultural organisations, creative practitioners, and small businesses to identify the carbon footprint of their work. This can be an especially onerous task for small businesses, organisations, or freelancers who may not have the capacity to carry out full environmental reporting. This tool aimed to promote actionable goals for empowering practical change by supporting their understanding of their carbon footprint. It also sought to demonstrate that not every detail about carbon footprints needs to be known to start making informed decisions about which changes to implement to manage and reduce emissions. For example, the tool asked users simple questions such as: what their creative practice entails (e.g., craft, music, theatre, and others), methods of work (e.g., freelancers, employ staff, work with audiences), information about buildings in which their practice and work is situated, and how transport was used for their work. The tool then collated an initial list of different types of emissions related to the work. The user was able to finetune by removing or adding other types of emissions, enabled by database searches of common activities. Critically, the tool helped the user sort the emissions into three categories: 1) the emissions over which the user can have *control* (usually those paid for, e.g. use of a car, taking a flight), 2) those the user can *influence* (e.g. heat and lighting in a rented building), and finally 3) those the user is *concerned* about but which may be more difficult to address (e.g. the carbon footprint of video streaming). From this guidance, users were able to devise an action plan to lower their emissions. It is worth noting that the tool has currently not progressed beyond prototype stage; a fully functioning tool would require a much more substantial development than the CI funding enabled. However, this pilot project outlined how data-driven innovation could empower better informed, and easier, decision making around carbon footprints by simplifying calculation.

Pop-Machina Data Collection Tool and Open Knowledge Tool

The Pop-Machina platform developed two separate tools that support the understanding of sustainability. The Data Collection Tool,[10] like Climate Friendly Culture, aimed to help makers and makerspaces understand their environmental impact. The platform enabled the calculation of the environmental impact of individual makers as well as larger makerspaces. For

example, a footprint for a given project can be calculated by assessing the amount of secondary materials used, the type of fabrication machines used and duration of use. When makerspaces recorded all their fabrication and maintenance operations through the tool, it was possible to judge their overall environmental impact, as well as to identify how future activities could be structured to bolster positive impact. Despite these benefits, the potential of this tool has yet to be realised due to two reasons. First, as highlighted earlier, only a few Pop-Machina makerspaces were operational during the pandemic period (2020–22), and the maker communities around these spaces were still developing when the platform was launched. Second, makerspaces which were operational chose to use other tools to keep track of their projects. For example, Leuven makerspace had been using an Excel sheet to record data about circular projects, which was subsequently adopted by the Istanbul makerspace. Despite this, Pop-Machina's Data Collection Tool partially helped makerspaces to enhance their understanding of environmental impact at a neighbourhood level. We also expect the tool will be adopted to a further extent when the makerspaces reach their full maturity.

The Open Knowledge Tool[11] aimed at enhancing makers' knowledge about the circular economy. The Pop-Machina Academy, led by Fab Lab Barcelona, developed core courses during 2020 which give an overview of the skills and tools required for the next generation of circular makers. These courses traversed various topics, including becoming a circular maker space and maker,[12] community building and orchestration,[13] and usage of circular materials (e.g., from e-waste to new life, precious plastics, additive manufacturing) (Schmidt et al., 2021). The Open Knowledge Tool is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License, CC BY-NC-SA. Although the Open Knowledge Tool registration is still emerging, mainly because the communities around Pop-Machina are nascent (as noted with the Social Collaboration Tool and Data Collection Tool), it demonstrated the potential of a dedicated online tool for specific training and open knowledge to support sustainable practice. Meetings with the administrators of Pop-machina makerspaces reflected that these tools are valued within existing maker communities.

Theme 3: platforms for empowering sustainable and circular communities

Beyond digital platforms that support sustainable behavioural choices, other work in the creative industries is also increasingly seeking to inform broader sustainable decision making. This may include considering how to encourage the adoption of more sustainable financial models or adopt practices that have a social benefit. In this section, we highlight case studies that move beyond behavioural nudges to also support broader social innovation at scale.

Creative Cred

Creative Cred was a speculative project funded by Creative Informatics emerging from a collaboration between circular economy agency Ostrero, economic anthropologist Dr Juli Huang, and creative technologist Dr Tom Flint. Creative Cred focused on developing a complementary currency to incentivise people in the creative industries to take a circular economy approach to their business. The currency, enabled by a digital backend, supported the exchange of measures of value beyond the financial: from the use of circular design principles to the provision of circular services. Creative Cred also supported social responsibility because it favoured exchanges between creatives in a localised network, thereby keeping financial value within the immediate economy. This in turn supported economic sustainability as the mutual credit system can keep goods, services, and materials flowing: a particular benefit in times of economic hardship when people might not have access to cash but they can still exchange goods and services. The Creative Cred model was informed by existing and functioning alternative currencies (e.g., Dini and Kioupkiolis, 2019) but has so far remained a speculative prototype. The project has much scope to be transformed into a functioning alternative currency. However, to do so would require a substantial upfront investment in both developing the digital 'back-end' infrastructure and in building a community of Creative Cred adopters. As with Climate Friendly Culture, Creative Cred developed an interesting conceptual prototype to fill identified gaps in provision of suitable and easy to use tools to support better decision making, a space data-driven innovation is uniquely placed to support. However, the upfront costs of R&D make this a difficult terrain to develop.[14]

Local Future Stories and co-designing makerspaces with citizen-driven values

Pop-Machina strove to support the establishment of circular makerspaces in seven European cities, engaging citizens as makers in these spaces. To ensure the success of the project, it was crucial to gather the perspectives of multiple stakeholders and communities of practice. Thus, the project aimed at co-designing circular makerspaces with the participation of existing makers and local stakeholders. In line with this aim and to create pilot activities reflective of citizens' expectations, their visions about circularity were collected through a technique called Local Future Stories (Galleguillos et al., 2023). A website was created to collect these citizen-driven stories about circular makerspaces. Participants first selected a scenario from a list (e.g., repairing, producing, materials collection, and so on) and were then asked to create a story pertaining to the future of their neighbourhood if it were to have a circular makerspace. The analysis of all the stories collected (131 in total) demonstrated that citizens see circular makerspaces as social, inclusive,

and economically supportive places for sharing skills and knowledge as well as for taking care of local problems. Local Future Stories thus enabled the identification of values each citizen prioritised and aligned the goals of the makerspace with these. This citizen-driven data tool enabled the planning and creation of makerspaces tailored to the unique needs of locals in each particular geography. For example, in the stories collected from Leuven, the prominent theme was community life and sharing. Citizens proposed to conduct repair café events regularly, and other hands-on workshops, in order to exchange knowledge and skills and to create deeper connections with the local community. These values were later reflected in Leuven's pilot activities, such as year-long activities of instrument making using various secondary materials to create a Leuven Makerspace Orchestra.[15]

Discussion

After undertaking our analysis, we reflect on how the case studies respond to particular Sustainable Development Goals, and whether they succeeded in achieving the transformational outcomes that would support social innovation to take place. In Table 11.1, we summarise how each of the projects aligns with our three questions. The examples align well with the SDG framework, specifically the following SDGs: fostering innovation (SDG 9), building resilient and sustainable communities (SDG 11), supporting responsible consumption and production (SDG 12), supporting climate action (SDG 13), and engaging in these processes through multi-stakeholder partnerships (SDG 17). These SDGs align mostly with social innovation (see Table 11.1).

The value of small data

The various types of data used in the presented projects ranged from user-driven data (e.g., values, visions, knowledge, skills), to design data (e.g., design patterns, records of makerspace projects) and material data (e.g., resources, equipment). As highlighted earlier, the fourth industrial revolution has predominantly focused on how data-driven innovation can be bolstered by Big Data – for example, large-scale datasets used to train AI and machine learning models. However, what is worth noting is that the types of data generated in our case studies were generally not Big Data. Rather, they focused on what can be called 'small' data, for example, the digitisation of locally embedded knowledge and experiences (e.g., in the Social Collaboration Tool, Local Future Stories, Open Knowledge Tool), supporting access to complex environmental data to enable situated decision making (e.g., Climate Friendly Culture, Data Collection Tool) and creating novel experiences to support changing consumption patterns (e.g., Custom Loop). Collecting data about

TABLE 11.1 Overview of Case Studies With Comparative Notes

Project/Case	*SDGs*	*Data Type generated*	*Environmental Innovation*	*Social Innovation*	*Transformation Aspirational Outcomes*
CI/Custom Loop	9 12 13	– design data: patterns – customer data	– tools to maximise efficiency	– increasing awareness – supports responsible ownership	– efficiency in production – tailored bespoke production – maturity in acceptance of principle
PM/Social Collaboration Tool	11 12 13	– user data – material database – skills database – resource database	– platform for sharing of skills, tools, and assets	– supporting community development	– impact at the local level – high-complexity application – low maturity in terms of usability and users' adoption
CI/Climate Friendly Culture	9 11 12 13	– carbon footprint – impact analysis – material database	– specific tool for measuring carbon footprint – tool to support climate action	– increasing awareness of environmental impact – support to prioritise deliverable change – support to enable informed conversations with stakeholders	– remains a speculative tool, so no measurable impact – in theory: what measures are deliverable versus all measures – no maturity yet in terms of data accessibility and culture

PM/Open Knowledge Tool + Data Collection Tool	9 11 12 13	– user data – ecosystem data (community) – carbon footprint – material database	– building capacity circular economy/ maker movement – general tool for data collection on circular economy in makerspaces	– support community building	Open Knowledge Tool – tailor-made content built from applied innovation cases – growing user database – engaging citizens in circular making Data Collection Tool – complex for systematic adoption – no measurable impact due to low adoption
CI/Creative Cred	9 11 12 13 17	– user data – material database – skills database – resource database	– system which rewards good environmental practice with 'cred' – system to support material exchanges and surplus	– system which rewards good social practice with 'cred' that can support more mutual benefit and exchange – skills share	– remains a speculative tool, so no measurable impact – in theory: by creating an alternative currency, external shocks are less impactful – no system maturity
PM/Local Future Stories	9 11 12 13 17	– user data	– a technique to integrate citizen generated data into the planning of a circular makerspace, facilitating citizen-driven innovation	– supporting community development – facilitating citizens' sense of belonging to makerspaces through co-design	– contributed to the design of circular makerspaces and their activities by tailoring them to the needs of local context – citizens involvement in makerspaces

materials used in creative practice facilitated environmental impact measuring, while enabling people to share and manipulate design data allowed for optimisation of production. Furthermore, gathering user-driven data facilitated community and capacity building. In sum, gathering, analysing, and putting into practice these various types of 'small' data supported a range of environmental and social outcomes. This emphasises how data that is 'small' rather than 'big', situated rather than generalised, and co-negotiated with a community can be viewed as a particularly promising material for data-driven innovation in the creative economy when the goal is to foster sustainable practices.

The importance of supporting existing data practices and ease of use in tools that support data collection

Data-driven innovation is contingent on the availability and quality of data. Tools that navigate data collection should therefore engage with data of a high quality. What we have found, however, is that for such tools, the methods for collecting and utilising data should be matched to the expectations, skills, and preferences of the stakeholders who will use them. Pop-Machina's Data Collection Tool, for example, collects detailed and accurate data about makerspace projects, such as the quantity of materials used, the type of equipment used, use duration, and transportation medium used to acquire the material. However, in practice, this goal of creating a tool to collect data that was as detailed as possible resulted in the system being perceived as too complex by the intended users, thereby reducing system adoption and in turn reducing the quality of the data collected. This further highlights how the adoption of tools for data collection also requires a 'community of practice' (Lave and Wenger, 1998). Hence, the work presented in this chapter demonstrates that when data-driven innovation applications are not easy to use, the transformational outcomes of the tools in terms of promoting sustainable practices through collecting and utilising data can become limited. Furthermore, as noted earlier, the role of the social cannot be overstated in determining whether the first (micro) cycle of social innovation is successful. It is only when the second cycle of social innovation is adopted, where institutional structures are re-negotiated, that data-driven innovation can be fully embedded at macro level (third cycle).

The Custom Loop app appropriates available technology (the industrial knitting machine) by limiting design options and colour in ways not normally applied to prototyping and thus augments production cycles. Arguably, Custom Loop was an outlier in our analysis, representing a more commercially focused application of data-driven innovation in pursuit of sustainability in comparison to the other case studies, the majority of which were from the third sector.

Data-driven innovation as a tool in a larger toolbox

The nature of data-driven innovation changes depending on the context and goals which are important to situate innovation. As such, data-driven innovation is another tool in the toolbox for navigating complex datasets and wicked problems. For example, here we have shown how data-driven innovation can be used in experimental projects, which, for example, explore means of supporting communities to become more sustainable by encouraging and giving credit to collaboration (Local Future Stories and Creative Cred) and demonstrate the value of data-driven innovation beyond metrics such as efficiency or better decision-making. As such, data-driven innovation can support alternative economic models, such as a circular or sharing economy, in which metrics for success and failure are more nuanced than in a linear economy where financial sustainability is paramount.

It should, however, be highlighted that successful use and adoption of data-driven innovation often requires a deep understanding of a community as well as longitudinal work. For example, whilst Pop-Machina's Data Collection Tool was a powerful system to collect and track carbon data, it was not widely adopted due to the nascency of the target community. Similarly, Climate Friendly Culture and Creative Cred remained speculative projects requiring both a developed community of practice and a significant investment of R&D to deliver the technology envisaged. As such we see a gap between what is 'possible' with data-driven innovation and what is achievable without considerable investment and development of the social and technical infrastructure to support the possible to become adopted data-driven innovation.

We argue that further longitudinal evaluation is needed to provide useful insights if the pilot projects and tools listed previously supported and sustained long term change. However, given the urgency of the climate crisis, we do not have the luxury of time. Furthermore, we must also caution that any data-driven innovation also comes with an often significant carbon footprint associated with data storage and processing, and this needs to be fully accounted for. This implies that the tools to create data about circularity should be better resourced to be made accessible, easy to use, and easily adaptable to the needs of makers as creative communities.

The importance of funding for sustainable creative futures

Investment in social innovation such as these, which particularly address the climate emergency and work actively towards a more circular economy, should receive a significant amount of the funding currently being invested in innovation. We identified data-driven innovation as a key method to be able to support better decision making in complex interconnected systems. Implicit to the outcomes of many of the projects we have presented is the

question of funding. A number of the projects remained speculative prototypes, as funding was not accessible to scale. It is possible that some of these projects might have developed into fully functional tools, given sufficient funding to develop minimum viable products (MVPs) and communities of practice. Like tech innovation, data-driven innovation for social good comes with risks. However, we suggest that in the context of the climate emergency, the risks of failure are worth it.

We also contend that the levers of social innovation have not been pulled by policy to the same extent as technological innovation in the context of a linear economy is being resourced. We thus propose that allocating resources, particularly using data-driven innovation, to unlock social innovation are opportunities that have been missed by policymakers. Nevertheless, independent circular makers or entrepreneurs may encounter challenges when seeking funding. This emphasises the significance of establishing active partnerships between creatives and supporting institutions (see also Chapter 2).

Conclusion

In this chapter, we have argued that data-driven innovation can support sustainability expectations in the creative economy. Specifically, we have demonstrated that data-driven innovation can enable social innovation in support of climate action. We argued that gathering and using data on existing (sustainable) practices in the creative economy, as well as accessing other forms of data external to the creative economy (e.g., supply chain information), is critical for creative practitioners to support sustainable activity. The gap remains in the development of credible and easy-to-adopt data gathering mechanisms and data literacy. Knowledge of and ability to work with data (Parkinson et al., 2020) is currently where the power resides and is critical for a future sustainable creative economy. We suggest that this indicates that data, data literacy, and access to data are critical to a sustainable creative economy agency.

We suggest that to further enable creative practitioners and creative communities to tap into the potential of data-driven innovation in context of sustainability, policymakers should work to ensure that these groups are supported in the following four ways:

1. Through *access to more funding to undertake R&D* in social innovation, including through the use of data-driven innovation for social good.
2. Through *resources, including funding, that enable the evaluation* of data-driven innovation for social innovation to measure the impact and effect of change.
3. By creating *scaffolding resources* to support creative practitioners and communities in forming complex partnerships and collaborations, as well as in upskilling in data-driven innovation.

4. By creating *signposting and routes to access* for follow-on funding to accelerate R&D.

We thus propose that data-driven innovation is a key tool to support sustainable social innovation, which is critical to enable a circular creative economy to fully develop. However, we argue that data-driven innovation at the intersection of a circular economy and collaborative production could be a much more powerful agent for change in support of embedding (social) innovation through the three-cycle model when data-driven innovation is given funding and time to be embedded.

Notes

1 Creative Informatics: https://creativeinformatics.org
2 Pop-Machina: https://pop-machina.eu
3 Framework for Strategic Development provides sustainability principles, practical tools and evaluative checklists that can be used in consulting and environmental management procedures. From The Natural Step: https://thenaturalstep.org/approach/
4 Pop-Machina Open Knowledge Tool: https://okt.pop-machina.eu/courses/becoming-a-circular-maker-space-maker/ but is accessible to members only
5 Pop-Machina Collaboration Platform: https://pop-machina.eu/the_platform
6 Pop-Machina Data Collection Tool is only accessible to members. For more info: https://pop-machina.eu/the_platform
7 Pop-Machina 'Local Future Stories': https://pop-machina.eu/news/news-items/local-future-stories
8 Social Collaboration Tool: https://popmachina.iti.gr/makerspaces
9 Climate Friendly Culture, short video explaining the tool: https://www.youtube.com/watch?v=260SoKK5O-s
10 Pop-Machina: Data Collection Tool: https://pop-machina.eu/project/abstracts/deliverable-4.7 or https://popmachina.iti.gr/tiles
11 Pop-Machina Open Knowledge Tools: https://okt.pop-machina.eu/courses/
12 Pop-Machina: Becoming a Circular Maker Space and Maker: https://okt.pop-machina.eu/courses/becoming-a-circular-maker-space-maker/
13 Pop-Machina: Community Building and Orchestration: https://okt.pop-machina.eu/courses/community-building-and-orchestration/
14 Ostrero: https://ostrero.com
15 Leuven Maakleerplek: https://maakleerplekleuven.be/?lang=en

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CASE STUDY

Constructing data-led social innovation: Edinburgh Tool Library

The following case study was informed by an in-depth interview with the Edinburgh Tool Library (ETL) which demonstrates how data-driven innovation can support sustainability expectations in the creative economy through social innovation.

The Edinburgh Tool Library[1] enables community members to borrow seldomly used tools rather than purchasing them. A tool library embodies a sharing economy where assets and knowledge are communal rather than accumulated individually. The key environmental argument for a sharing economy is that pooled assets reduce the need for production of expensive products or technology, thereby lowering emissions by producing less and making more of existing or fewer assets.

The key data-driven question for Edinburgh Tool Library was how much carbon was being saved by borrowing rather than purchasing a tool. They had been working on augmenting their tool management system in which data about tools and their uses is stored, with additional information about the environmental impact of sharing. The system was designed to inform its members about how they are reducing their own carbon footprint through borrowing but also to provide evidence about how Edinburgh Tool Library is reducing the community's climate impact more widely. Furthermore, Edinburgh Tool Library was looking for a 'dashboard' to bring all the data it collected through its tool management system together that would reflect its successes back to its membership, as well as existing and future funders. In other words, it wanted to make better use of the data it already had.

> We realised that the data wasn't actually . . . a bit like a tool on a shelf, wasn't working to its full potential, and there was lots of things with a few tweaks that we could find out, in terms of carbon footprint reduction.
>
> (ETL interview)

Edinburgh Tool Library uses a proprietary software platform called myTurn,[2] which is an inventory database used by rental companies to track their stock when out on loans. This North American software has been made available for free to many tool libraries internationally as part of the company's corporate social responsibility. According to Edinburgh Tool Library, 95% of tool libraries across the world use this system to keep track of their tools and keep records of its members. Edinburgh Tool Library wanted to access and combine data it already had (tool loans) with external data on the carbon released in the making of a new tool – 'cradle-to-gate' processes such as extraction of raw materials,

transportation, refinement, and production of raw materials into a finished product. The new carbon calculation tool drew on data from three different databases:

1. The Inventory of Carbon and Energy (ICE) by Circular Ecology and the University of Bath.[3]
2. The Climate Impact Forecast – Life Cycle Assessment (LCA) for startups and impact entrepreneurs.[4]
3. Greenhouse Gas Reporting: Conversion Factors 2020, UK government.[5]

This created a new data set that was able to tell the story of how much embodied carbon was being prevented entering the atmosphere each time a tool was borrowed. The new dataset includes 12 common emission types, categorised by the materials in common tools (metal, plastic/rubber, mixed plastic/metal, mixed wood/metal, mixed plastic/wood, wood, aluminum, plastic, cordless power tool, corded power tool, petrol based, electron equipment). When the 12 common values are combined with the borrowing history of Edinburgh Tool Library's tool management system, the carbon saving for any time period, tool type, or member can be calculated. The calculation for each tool is 'number of times tool was borrowed instead of bought' × 'weight of tool' × 'emission factor' = 'carbon saved.' At this stage other carbon savings such as waste reduction, recycling, and material re-use are not part of these calculations.[6]

This project, funded by Creative Informatics, was further enabled by the unique circumstances of the global pandemic. In the UK many employees were put on a government-supported furlough scheme which compensated working people not able to work in these circumstances. The Scottish Tech Army[7] galvanized furloughed or unemployed people with IT skills to volunteer and supported Edinburgh Tool Library to help build this new user interface. A visible outcome of the software development has been the development of a 'carbon receipt':

> When you borrow a tool from the Edinburgh Tool Library, instead of having a . . . this costs three pounds, and so much is VAT, it'll come back saying, this costs you nothing, but you've reduced your carbon footprint by 8 kilograms. It's just those little tweaks that . . . we'd like to see filter into . . . a broader spectrum of society.
>
> (ETL interview)

The rationale of a tool library is that sharing equipment and know-how through a network of staff and volunteers makes an economic as much as social contribution. By having access to physical objects, access to knowledge, networks, and social infrastructures is enabled too.

The carbon tool developed by Edinburgh Tool Library, with R&D funding from Creative Informatics and in collaboration with myTurn, with additional support from the Scottish Tech Army, has enabled them to share this new tool through the international network of tool libraries. This small data-driven innovation project has thus enabled more than 400 libraries across the world to access and contribute additional data to the system, thereby finetuning the data through crowdsourcing. This example demonstrates how data-driven innovation is helping to embed social innovation by supporting the meso level of social innovation described in this chapter.

Together with the previous case studies, this example shows how – where the goal is to alter and reduce consumption and ownership – data and data-driven approaches support an understanding of motivations for the (dis)use of their objects, as well as how to augment their perceived and use value. For Edinburgh Tool Library, value is made visible by demonstrating how the objects they loan and maintain – when situated in a specific social and technical context – have impacted the community and worked to reduce climate impact.

Coda

The Edinburgh Tool Library case study was presented alongside seven other case studies in a short film, *Data-Driven Innovation for Sustainable Creative Practice*,[8] presented at the inaugural New European Bauhaus in Brussels in June 2022, which is a flagship policy by the European Union to bring creativity and interdisciplinarity to the New European Green Deal as a means to deliver on 2050 target of Net Zero.

Inge Panneels and Susan Lechelt

Case study notes

1 https://edinburghtoollibrary.org.uk
2 https://myturn.com
3 https://circularecology.com/embodied-carbon-footprint-database.html
4 https://climate.impactforecast.org/about/
5 https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020
6 See also https://edinburghtoollibrary.org.uk/carbon-data-for-sharing-libraries/
7 https://www.scottishtecharmy.org
8 Available at: https://vimeo.com/723299867

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