

Institution: Nottingham Trent University (NTU)
Unit of Assessment: D32 - Art and Design: History, Practice and Theory
<p>1. Unit context and structure, research and impact strategy</p> <p>Context</p> <p>The Unit's vision for Art and Design has been to optimise the strengths of and the interplay between its practice-based and theoretical research, alongside long-term collaborative, interdisciplinary relationships within and beyond the academy, to generate world-leading research and outstanding scholarship. This encompasses highly creative art and leading-edge science, often in the same project. As a result, Art and Design at Nottingham Trent University is experiencing a period of unprecedented success, being positioned in the Top 100 of the QS Top University Guide for the past three years.</p> <p>The focus of the Unit's research environment has been to drive collaboration and interdisciplinary activity between academic and non-academic partners, both nationally and internationally, delivering on the Unit's ambition to advance knowledge, deliver high-value research with significant impact, and address societal challenges. The achievement of these strategic aims have been most exemplified in Art Practice, Design, Fashion and Technical Textiles and can be demonstrated through key indicators:</p> <ul style="list-style-type: none"> • The proportion of Unit staff engaged in highly creative, practice-based research has increased in this REF period, with 40% of outputs being 'non-standard' (designs, exhibitions, patents, products, etc.) compared to 26% in REF2014. • The number of staff in scope for the REF has grown from 20.90 to 30.89. • PGR completions have risen by over 100% from 2.5 per year to 6.8 per year. • HESA research spend has risen by 198% (at £6.73 million) and non-HESA spend by over 300% (at £1.35 million). <p>Central to our accomplishment of these notable outcomes has been the development of a robust support structure for staff, with strong research leadership ensured through the strategic recruitment and retention of senior staff charged with establishing and expanding four collaborative Research Centres. Overall, we have nurtured a vigorous research environment, as we detail below.</p> <p>Research Leadership and Structure</p> <p>NTU's submission to the Unit comprises 30.89 FTE staff, 87% from the School of Art & Design (A&D) and 13% from the School of Architecture, Design and the Built Environment (ADBE).</p> <p>A major innovation at NTU since REF 2014 is the investment in Associate Deans for Research (ADR) in every academic school; Kaner directs research in A&D whilst Sun undertakes this role in ADBE. ADRs work together to oversee the implementation of NTU's research and impact plans, acting as conduits between the Schools and NTU's research governance committees. Importantly, both are members of the University Leadership Team.</p> <p>Kaner has overall responsibility for this Unit and is supported by the Unit of Assessment Coordinator and the A&D REF Steering Group as well as Athena Swan Champions, Research and Innovation Committees, and Early Career Researcher (ECR) Groups within the two Schools. Support is provided by NTU's significant investment in Research Operations (Pre-Award, Research Governance Teams) and Research and Strategic Partnership Development (Grant Development Support) teams.</p> <p>Research submitted to the Unit is structured around four Research Centres: <i>Artistic Research Centre</i> (in A&D); <i>Design Research Centre</i> (in A&D); <i>Fashion and Textiles Research Centre</i> (in A&D); and <i>Product Innovation Centre</i> (in ADBE). These Centres embody the areas of focus of the Unit's research: Arts Inquiry; Design Application; Product Design Innovation; and Textile</p>

Heritage, Practice, Technology and Sustainability. The Centres feed into and are enabled by NTU's five overarching areas of strategic research priority: Global Heritage; Health and Wellbeing; Medical Technologies and Advanced Materials; Safety and Security of Citizens and Society; and Sustainable Futures.

The Centres enhance the research culture and develop new areas of research (artificial realities, material circular economy, and soft robotics). They facilitate research prioritisation, enabling the Unit to focus both on pre-existing strengths (Artistic Research, Advanced Textiles, Fashion and Textile Heritage) and on emerging areas (Energy Harvesting for e-textile garments, Product Design life-cycle innovations and Visual Communications intelligent solutions). The Centre structure provides focus for researcher development (PhD to Professor) and opportunities for forming collaborative teams leading to new research and impact. In addition, this structure is enhancing the ability to network across the University and externally, leading to greater collaboration with business and industry. Moreover, it is increasing the capacity to co-ordinate joint funding applications with commercial organisations, supported by the Research Operations team alongside the expanded Research and Strategic Partnership Development team.

The Artistic Research Centre (ARC - led by Higgins) covers disciplines ranging from theoretical inquiry to material-based practice. Members have received fourteen Arts Council England grants totalling £197,546 during the census period. The Centre includes practitioner-researchers using a variety of approaches in a range of media: digital, painting, print and sculpture. Research within the Centre demonstrates the value of long-term collaborative activity in promoting new knowledge through artistic practice. For example, Higgins' work 'Down on the Farm' (2014 - 2020) involved collaboration with 10 museums across Eastern Europe and the former Soviet Union in a long-term project exploring the interpretation of Soviet histories. Cocker's work 'Choreo-graphic Figures' on drawing, choreography and writing (2014 - 2017) demonstrates long-term international collaboration with European scholars, as does Maier's and Kaner's work on 'Topographies of the Obsolete' (2012 to present) with UK and international collaborators in Denmark, France, Germany, Norway and Switzerland.

The Design Research Centre (DRC - led by Ford), submits to two REF Units (Art and Design: History, Practice and Theory, and General Engineering) and includes Design Theory, Engineering Design, Graphic Design, Personalisation and Product Design. This Centre accommodates the Design Matter Research Group (a 3-year £250,000 NTU strategic investment) and includes several practitioner-researchers who work on a wide variety of industry-focussed projects and products, including product design, medical device design and product disposal. The Centre has secured £1.14 million of Research England Connecting Capability Funding (CCF) to deliver the Impacting Business by Design (IBbD) design support project. Activity over the census period has focussed on supporting new product development and on issues around product disposal and design for a circular economy. Fisher's work on understanding motivations for product disposal (2014 - 2015) and Ford's work on the use of recycled plastic in new product development (2014 - 2016) both explored the complicated challenges around the disposable economy. In addition, Ford's work on effective use of design in supporting Small and Medium-sized Enterprises (SMEs) (2012 to present) has demonstrated a real-world application of practice-based research which has led to collaborations with partners in Australia, China and Oman on ways for universities to support SMEs in new product development.

The work of the Fashion and Textiles Research Centre (F&TRC - led by Briggs-Goode), combines breadth with coherence, including Advanced Textiles, Archival-Based Historical work, Conservation Heritage and Sustainable Fashion. The Centre spans developments ranging from the application of knitting technology in space (Dias) to innovative research on social practices of Folk Fashion (Twigger-Holroyd). Alongside the Advanced Textiles Research Group (ATRG), the Centre accommodates four Research Centre sub-themes: Fashion and Textile Business; Fashion and Textile Cultures; Fashion and Textile Design; and Fashion and Textile Heritage. These explore both theoretical and practical aspects of fashion and textiles. Much of the Centre's research is underpinned by long-term practice-based activity; this is exemplified by Edwards' work on South Asian textiles as part of the 'By Design' British Academy International

Partnership (2014 - present), Townsend's work on 'Emotional Fit' (2014 - 2017), and Dias' novel research on 'e'-yarns (Dias's £1.4 million EPSRC funded research on integrating flexible filament circuits for e-textile applications) which is an impact case study in REF2021.

The Product Innovation Centre (PIC - led by Al-Habaibeh), submits to two REF Units (Architecture, Built Environment, and Planning and Art and Design: History, Practice and Theory). The aim of this Centre is to drive innovative change through interdisciplinary work. For this Unit, researchers are engaged with product design, working with industry and government partners, to improve people's lives by providing applications and products in response to medical needs. There is crossover here with the DRC where collaboration occurs through project-based investigation and contract research work. The Centre is underpinned by long-term practice-based activity, including Cooper's research on sustainable waste re-use for clothing at 'end of life' (2013 - 2018) and Breedon's wide range of medical device applications spanning 2014 to the present (including FRAME: Facial, Remote Activity Monitoring Eyewear device (2016-18), an inconspicuous, mobile sensing device for real-time control of assistive technologies through facial expression). The Centre has international impact, for example Cooper's £1 million EPSRC grant funded research to study embodied energy and product lifespans influenced UK Government and European policy; this included providing evidence at a House of Commons Audit Committee on Electronic Waste in the Circular Economy in April 2020. The Centre has also been successful in securing over £0.5 million DTA3/COFUND Marie Skłodowska-Curie funding for PhD fellowships to NTU.

Research and Impact Strategy

REF2014 strategic aims capitalised upon the range of both practice-based and theoretical work coupled with interdisciplinarity and collaboration within the Unit. Many project engagements have been 'long-term' in nature (e.g. Dias, Ford, Higgins, Townsend, Cocker). Frequently, they involve activity between academic and non-academic collaborators, enabling research to build strategically over time, achieving and maintaining deep-rooted mutual understanding. Our impact strategy has capitalised on this approach, building on long term projects with industry and sector collaborators.

Achievement of REF2014 strategic aims

The specific research objectives presented in the Art and Design: History, Practice and Theory submission for REF2014 were based on developing activities in Art, Textiles, Sustainable Consumption and Product Design, aligning these activities to NTU's areas of strategic research priority. These objectives and outcomes are:

- a) Increase the quality of all outputs

Increased output quality is evidenced through the current suite of submitted outputs with over one third of outputs being internationally co-authored.

- b) Increase research income

HESA returnable research income has increased by 198% (to £6.73 million) during the period and non-HESA income increased by over 300% (to £1.35 million).

- c) Expand PGR numbers

National and international PGR numbers have increased from 15 to 21 and PhD completions per research-active staff (FTE) increased by nearly 100% from 0.54 (REF2014) to 1.0 (REF2021) during this census period.

- d) Use group structures to consolidate research across disciplines

The Research Centre structure has been established to facilitate research across disciplines (e.g. Fisher DRC, Briggs-Goode F&TRG – "Textile Tales" project funded by the Heritage Lottery Fund (HLF) with £70k which brings together researchers across disciplines in an ethnographic approach to the oral history of the textiles industry in Derbyshire).

e) Contribute to national and international priorities

Research in Sustainable Fashion (Cooper, Edwards, Townsend, Twigger-Holroyd) is addressing the consequences of the existing fashion-manufacturing infrastructure. Ford's work is leading to effective re-use of plastics in new products. Textiles Heritage research (Briggs-Goode) has investigated the social impacts for the East Midlands of global shifts in textile production.

f) Extend and develop research impact (particularly by R&D in advanced textiles)

The impact case studies of Arm (thoracic surgery education), Edwards (Gujarati block printers) and Dias ('e' yarns and space technology) show the breadth and reach of the Unit's research. In addition, there are numerous engagements with galleries, public bodies and industry leading to considerable impact.

Impact

Development of impact has been a key strategic theme throughout the current REF period, greater engagement with partners (see below) in the design of research projects and investment in impact-generating activities within research projects. The Unit has developed a range of sustainable mechanisms to help incubate the best impact from our research at all stages, and has targeted resources that contribute towards prioritising impact pathways, including:

- Funds provided to project award holders to develop impact using strategic funding, for example the work with intangible heritage by Edwards where an impact officer role was supported to negotiate with external partners in India to identify and collect evidence of impact leading to a better understanding of the effects of the research on intangible craft communities.
- Studentships that lead to impact through development of products that have benefits to advancing technologies, such as the NTU funded studentship to develop pressure relief system for ulcers supervised within ATRG.
- Staff time through using central university staff support for developing and bidding to research councils where researchers work closely with the Research and Strategic Partnership Development team, such as Townsend who recently received UKRI funding to develop PPE clothing into a more flexible system to accommodate a wider range of size and BMI, which will impact on health providers comfort and agility.

Using a range of media, (press, TV, internet) to extend the reach of impact to wider communities has also been an effective mechanism, for example the impact generated by Arm's research for TraumaFX in advancing their ProSimbodiesTM was televised through the BBC Today Programme on 7 February 2020 and the work by the ATRG on e-textiles has also been aired in 2018 through the Tomorrows World programme reaching over 2 million viewers.

The Unit's specific approach to impact has been to position our research so that it can make a positive effect on real-world communities, including in Europe, North America, and South Asia, where the results of the research benefit people directly. We do this by targeting strategic partners with which we wish to engage, including industry, and governments and charities which can shape policy and practice in the specific fields where our work is positioned. This has resulted in real-world impact that is evident in each of the Unit's impact case studies (REF3). These embrace a topic range typical of the breadth and significance of the Unit's research, from physical science to ethnography and heritage, resulting from both non-academic collaborations and practice-based activity.

Real world impact is further reinforced through the work of our Research Centres that have demonstrated strong industry and other non-academic collaborations across the arts, health, and fashion. These include major companies, such as Adidas (Dias), BooHoo (Cooper), BT (Ford), PepsiCo (Breedon) and Speedo (Hurley). Ford's work with BT on understanding the limitations in using 100% recycled plastic in product design has generated findings adopted by Humax, VTec, SageComm and Arcadian. Breedon's work with the Engineering Innovation

Group at PepsiCo has led to numerous collaborative technical design projects, which includes, research linked to the utilisation of additive manufacturing processes for bespoke robot system design, autonomous mobile robots (AMR) simulations for new factory installations, and the integration and simulation of new production line seasoning technologies. Additionally, Breedon also completed impactful research for Tesco through the development of a modular universal gripper system for snacks packaging and disruptive technologies to improve the restocking of high volume, low cost snack products on supermarket shelves.

Interdisciplinarity

The Unit is highly interdisciplinary and deeply engaged in NTU's cross-disciplinary priority areas facilitating numerous collaborations at all levels across Research Centres, areas of strategic research priority and PhD projects. It utilises university-level fora and project-showcasing workshops to identify and grow its interdisciplinary activities and networks.

Examples of interdisciplinarity include:

1. Work in heritage science, bringing A&D's textile heritage work together with NTU's Imaging and Sensing for Archaeology, Art History and the Conservation (ISAAC) Lab in the School of Science and Technology, arising from an EPSRC-funded network in 2009. This work is integral to NTU's first Research Peak that has been launched with significant investment (£500k pa) to exemplify NTU's approach to excellence and societal impact (REF5a).
2. 'Score', interdisciplinary performance art that draws on archival images from historic lace manufacturers in Nottingham, mapped as musical scores and reinterpreted as artefacts by Maier (2019).
3. Research undertaken in the Medical Technologies and Advanced Materials strategic research priority area, combining expertise and skills from both Advanced Textiles and Product Design, resulting in novel devices, including a 'steerable' bougie to support airway intubation (Breedon) and medical simulation in collaboration with NTU's Department of Engineering (Arm).

These and other collaborations have attracted funding in excess of £1M from AHRC, EPSRC, HLF, BritAc and GCRF. In many cases, the interdisciplinary teams for these projects are international, and include SMEs and NGOs, for example MySIGHT (through Hunt) and the Shrujan Trust (through Edwards).

Open Research Environment

As part of NTU's commitment to go beyond the REF Open Access policy, the Unit is working with the University data management team to build an innovative repository of creative practice-based research data and to provide appropriate access to this through NTU's Worktribe repository system. NTU's Library is perfecting how best to interpret 'open access' in the context of these non-standard outputs and to put in place a solution that overcomes the limitations of the repository software (ePrints) when archiving practice-based research. Sector-wide best practice has been adopted, integrating the *Kultur* plug-in to the repository that allows for the deposit of supporting digital content in a range of multimedia formats. Researchers are encouraged to exploit this opportunity and guidance has been created to support them with this. The data management team is also developing an improved Open Access practice for more standard scientific data that is generated through more technical projects.

All means of dissemination comply with NTU's Open Access policy. Journal articles are uploaded and made accessible through the University research management system, Worktribe, (within three months of the editor's acceptance).

The Future Five Years

Over the next census period, the Unit will continue to capitalise upon its breadth of activities, its interdisciplinary and collaborative nature, and its strengths in practice-based and theoretical

approaches. This will drive further expansion in the quality, volume, and impact of its research. It will take advantage of the projected growth of A&D colleague numbers, ever strengthening connections with industry, and capital investment of £46m in new facilities. This will enable deepening of existing areas of expertise in Art Practice, Design, Fashion and Textiles and developing of new areas of research in creative technologies. The concentrated focus on developing world leading research and impact will only intensify, through the following aims:

1. Establish a new research group of international standing, through the creation of C3 (£34m capital investment), building upon the emergence of Artificial Intelligence and Augmented Reality within the Creative Industries.
2. Realise the benefits of the development of a cross disciplinary 'Research and Innovation Lab' (£12m capital investment), focusing upon research in e-yarns, lace heritage, art and place-making, design for health, surgical education and training, and economic and environmental sustainability in design and fashion.
3. Increase the quality, quantity, and frequency of collaborations on research and impact with academic and non-academic organisations and further develop the portfolio of strategic partnerships (e.g. Adidas), extending the international reach and reputation, contributing to higher QS world rankings.
4. Expand the PGR population by building upon the success of the AHRC M3C and M4C DTPs and increase the number of externally-funded doctoral candidates, including collaborative PhD's, with industry partners and international dual award programmes.
5. Increase the combined Unit income portfolio by 50% over the census period by optimising the interplay between our research and practice activities from HESA and non-HESA sources. This will generate opportunities for additional commercialisation of our research and practice-based activity.
6. Develop an inclusive and dynamic research environment that retains and recruits high quality research staff. The Unit will grow the number of research active staff aligned to the Centres, with a clear commitment to promoting equality, diversity and inclusion and work towards an Athena Swan silver application.

The Research Centres will be the main vehicles for delivering these aims through the following Centre-specific objectives:

- Grow activity in the ARC which will refine research in critical practice and critical theory. It will expand its practice-research in investigative photography, critical visual arts and screen and stage in ways that question cultures and memories using interdisciplinary research methods.
- Focus the F&TRC on expanding its work in textile heritage and craft contexts. The significant work of the ATRG will be progressed and broadened so that its considerable expertise creates new opportunities in NTU and beyond. The Centre intends to 'reimagine fashion research' and take full advantage of NTU's Research Peak on Cultural Heritage (REF5a) and the significant institutional investment being made therein.
- Expand the DRC interdisciplinary body of design researchers and practitioners, capitalising on its ability to integrate research, practice and commercial interactions. Core development themes will be Circular Economy Practice in design, Design for Health, and the use of state-of-the-art creative technologies in design (C3). Strategic partnerships with industry will be expanded in order to capitalise on research, practice and commercialisation opportunities. The Centre will also exploit the £23M investment in the Medical Technology Innovation Facility (MTIF), supporting the work of Dias, Breedon, Meadwell and Ford.

- The PIC will continue to drive innovative thinking and solutions through an interdisciplinary product design and engineering team that addresses global challenges. PIC, as an innovation hub, will enhance its work with colleagues across the University to deliver true multidisciplinary research outcomes that make a positive impact on people's lifestyles, industry and society.

By 2025, the Unit will be a major research force in the Art and Design sector with world leading recognition in Art Practice, Design, Fashion and Textiles, and internationally proven strengths in new areas of Visual Communications. The number of researchers in the Unit will have expanded by 25%, which will include more professorial staff who have been attracted by our world class facilities, exciting and novel research opportunities, and high performing environment.

Ethics and Integrity

Matters relating to research integrity, including research ethics, are overseen centrally (see REF5a) and managed locally. The University Research Committee, chaired by the Deputy Vice-Chancellor – Research and Enterprise, and reporting to Academic Board, is responsible for the development and monitoring of research integrity policies and procedures. The University Research Integrity sub-Committee has responsibility for the implementation of the Concordat to Support Research Integrity and the production of a publicly available annual statement on research integrity, which is presented to Academic Board. A Code of Practice for Research, Research Ethics Policy and Procedure, Research Data Management Policy and Responsible Metrics Statement provides the policy framework.

Robust scrutiny of projects undertaken by staff and PhD candidates in the Unit is overseen by a committee including reviewers from ADBE and the School of Arts and Humanities, in addition to those from A&D. This approach ensures projects are scrutinised from different disciplinary perspectives. Undergraduate and Postgraduate Taught student research is also subject to ethical review, where needed, and this is undertaken by a committee operating at School-level.

2. People

The Unit's submission comprises 30.89 FTE. By headcount, 25% are professors, 13% are associate professors, 48.5% are lecturers and 13.5% are postdoctoral research fellows. The submission includes 35% females and 13.5% ECRs.

Staffing Strategy and Staff Development

In addition to developing existing researchers, A&D has selectively recruited senior staff to provide research leadership, clear direction, and mentoring for research colleagues. Acquisitions have included: Kaner as ADR, 2017; Marsden as Dean of Art and Design in 2017; Ford as Professor of Design in 2018; and Bohr as Associate Professor for Visual Communications in 2020. Four internal promotions to associate professor have been supported during the census period: Cocker, Maier, Townsend, 2016-17 and Twigger-Holroyd, 2018-19. Two staff, Briggs-Goode and Edwards, were promoted to professor in 2018-19.

The number of staff with significant responsibility for research has increased from 17.9 FTE from A&D and 3 FTE from ADBE in the last census period to 26.89 FTE from A&D and 4 from ADBE. The gender balance of senior researchers in the Unit has improved. In REF2014 there were three female readers, no female professors, one male reader and seven male professors. In REF2021 there are four female associate professors, one male associate professor, two female professors and six male professors.

Postdoctoral Researchers

NTU has fully implemented the principles of the Concordat to Support the Career Development of Researchers. In line with this, A&D supports an active ECR Group, convened by two senior research fellows. This delivers research development sessions and writing 'retreats' that cover grant application, impact and publication, and administers ECR prizes that support project development and hosts presentations from experienced researchers. During 2018, Twigger-Holroyd was selected to participate in the University's 'winning grant funding' scheme, run by the University's Research and Strategic Partnership Development team to develop ECRs, which

provided support from mentors from different academic schools giving insights into applying for grants from other disciplines. Twigger-Holroyd has since won two AHRC awards, one as PI and one as Co-I (2018/2019). From 2018, ECRs have been supported through A&D's network scheme funded by £20k p.a. of institutional strategic investment to attend and participate in international networking events, often attached to conferences.

NTU has developed a more structured and transparent approach to the allocation of research time during the REF cycle to support staff with the delivery of high-quality research. Individual Research Plans (IRP) form part of the workload planning process, providing allocated time for staff to focus upon research. IRPs are used to support staff to deliver at the requisite level based upon research outputs, impact generation and research grant capture (whilst remaining cognisant of career stage and equality and diversity characteristics). This performance-based approach to research-time allowances has led to the sustained increase in both quality and quantity of outputs.

Under NTU's staff appraisal system staff meet formally three times a year with their line managers to discuss individual objectives and development needs informed by the IRP for research-active staff. These appraisals generate a set of objectives and development/training goals for the year and clearly define how these will be achieved. Objectives and goals are monitored continually throughout the year. Appraisals provide a formal opportunity to explore in detail the relevant support options to enable individuals to develop their research interests. This encompasses research development, sabbaticals, funding applications, access to resource and expertise.

Mentoring

All staff in the Unit have an allocated mentor who they meet on a regular basis. The appraisal system is complemented by an ongoing process of formal and informal approaches to mentoring and review. Formal mentoring includes a research leader being present at an individual's appraisal meetings and applies to both ECR and more experienced research staff. Informal mentoring occurs routinely in Research Centres, Sub-themes and Research Groups. In addition to this, all staff can approach experienced active researchers (associate professor or professor) both formally and informally, who can advise on strategies for developing quality research ideas into funding proposals.

Mentors support the dissemination and publication of research. Practice-based researchers have benefitted from using internal and external expert review to improve practice-based research by developing the research dimension of their work.

The research mentoring system also helps identify where impact through research might occur and mentors are encouraged to provide advice on what support should be put into place to facilitate achieving that impact.

Career Support

Several career development opportunities and mechanisms demonstrate a commitment to support individuals' career progression. This support includes preparing staff for PhD supervision through regular training and development. Early Career Researchers are encouraged to join supervisory teams and are supported through the leadership and mentorship of more experienced colleagues, for example Hughes-Riley under the mentorship of Dias.

Sabbatical research leave equates to approximately 12 months of staff time a year funded from an annual budget of approximately £65,000. This institutional strategic research investment funding is managed in a competitive manner based on research quality, appropriateness of outcomes and alignment with the University's strategic research priority areas and Research Centre activities. Fractional staff are treated in the same way as those with full-time posts.

Support from the sabbatical scheme has led to high-quality outputs and grant applications that have developed individuals' research careers. For example, Hunt's sabbatical support in 2017 resulted in a British Academy award and the production of related high-quality journal articles. In

addition, Twigger-Holroyd's progression to associate professor (2019) was underpinned in part by high-quality publications that were facilitated by sabbatical awards.

Postgraduate Researchers

The average number of PhD completions from 2013–2018 was 6.8 per year, significantly above the 2.5 per year in the previous census period. NTU was a lead partner (with BCU, Birmingham, De Montfort, Leicester, and Nottingham) in the AHRC Midlands 3 Cities (M3C) DTP, which saw the expansion of partners (Coventry and Warwick) and a successful new bid for Midlands 4 Cities (M4C). This DTP has the mission to recruit the next generation of Art and Design researchers and develop PGR-staff collaborative networks, symposia, conferences, training, and placements. The Unit has been successful in winning 10 funded studentships from the M3C/M4C and an institutional investment of £830,000 in doctoral bursaries for A&D. The PGR community is cross-disciplinary; of the 10 AHRC funded studentships, 2 are in Fine Art, 2 in Photography, 2 in Design (funded under the M3C programme), with 2 more in Fine Art and 2 in Design funded under the more recent M4C consortium. During the REF period A&D has seen a steady increase in student satisfaction in the PRES, at 83% against the sector average of 81%.

Leading NTU's contribution to M3C/M4C, Unit staff had a primary role in co-ordinating recruitment of 68 PGRs across 4 NTU academic Schools and 11 subject areas (Cultural Studies, English, Film & TV, Fine Art, History and Heritage, Law, Linguistics, Photography, Philosophy, Physics, and Textile Design). Through the DTP, A&D works with researchers in 7 Midlands universities (BCU, Birmingham, Coventry, De Montfort, Leicester, Nottingham, and Warwick) to develop the next generation of Arts & Humanities researchers and develop PGR-staff collaborative networks, symposia, conferences, training, and placements.

Of the 34 students currently registered (2020), 14 are pursuing practice-based research, with others adopting other empirical and analytical approaches. Supervisory support draws upon a pool of experienced supervisors from within the Schools and with specialist supervision from other Schools when required (out of 34 teams, 7 include supervisors from outside of A&D).

Postgraduate Researchers (PGRs) are fully integrated as part of the research culture, echoing the Unit's diversity across theoretical and practice-based research activity. A variety of PGR practice-based contributions have included: *"a study for e-textile illumination for automotive interior applications"*; *"what is the impact of the female voice in shaping Serbian art and conflicts representations"*; and *"supporting people living with a 'hidden disability' through textile developments"*.

The interdisciplinary PGR community is located in a central position in both Schools' estate. PGRs have access to extensive workshop facilities that cater for a wide range of media from video-production and motion capture, through ceramics and furniture manufacture, to leading-edge specialist equipment, such as rapid prototyping and manufacturing machinery, Stoll flatbed knitting machines and digital textile resources (including analytical equipment for materials testing).

PGR supervisors assist in brokering relationships with non-academic partners by engaging with professional organisations, commercial enterprises and national charities, including the Institute of Conservation, Rolls Royce and MySight Nottinghamshire (with one PGR being allocated per collaboration). PGRs are encouraged to share their research findings through publication (e.g. Piscicelli with Cooper and Fisher). They are often ambassadors (e.g. Sienna for Breedon) at conferences and networking events.

Art-based PGRs have access to a network of collaborators and partners, including Nottingham Contemporary, New Art Exchange, and studios at Primary and Backlit in addition to having links with external partners via supervisors such as Emmanuel House (Townsend) and numerous SME's via the IBbD CCF project (Ford).

Collaborations have led to a number of training and research outcomes, for instance students developing programming skills in the area of computerised knitting (in collaboration with industry) leading to a career in that sector (knit industry) and placements with national galleries

(Nottingham Contemporary, Whitechapel and Tate) as part of Midland 3 Cities (M3C) and Midland 4 Cities (M4C) activity.

PGRs are actively engaged with the Research Centres. They participate in quarterly School events and regular seminars which offer opportunities to expand their knowledge of the research within A&D. In addition, they are encouraged to attend larger one-off conferences, for example: the School's Research Conference in early 2020 (with 73 attendees from NTU); and the MOTIF Tsunami symposium and exhibition in 2019 which attracted 130 attendees at the symposium and 3500 visitors to the exhibition in the Bonington Gallery.

PGR generic training and administration is managed by the Doctoral School. All students have at least two supervisors with 12 mandatory meetings each year. Students produce interim and annual monitoring reports as part of a formal process of feedback with supervisory teams. In addition, all students must submit a Project Proposal (after 6 months) and an MPhil to PhD Transfer Report (at 12 to 18 months), reviewed by the School Research Degrees Committee.

Supervisory teams mentor PGRs in their career development and encourage development through both training and working closely with these experienced researchers. All research students enrol on the NTU Doctorate Plus Programme of workshops and training events to support their professional development, which is mapped to the Vitae Researcher Development Framework.

A&D runs two research training programmes specific to Art and Design methods. Methods and Theory in Art and Design (MATAD) and Doctoral Research Encounters in Art-based Methodologies (DREAM) take the form of half-day workshops occurring twice per term, with 10 students per session attending. This has led to several training and research outcomes, for example, students integrating interpretative phenomenological analysis (IPA) into their research through cross-disciplinary engagement with Social Science colleagues.

Equality and Diversity

NTU was awarded a bronze Athena Swan charter mark in April 2019 (see REF5a) and targets a silver submission in 2023. Supporting this, the A&D strategy aims at departmental Athena Swan submissions from 2022: application teams are currently conducting reviews, including cultural surveys on gender identification, promotion prospects and support, as a basis for developing an action plan for moving towards gender equality. The School's Athena Swan champion ensures: local funding and promotion panels are inclusive and diverse; monitors and reports EDI data related to equality of opportunity (funding, studentships and promotions awarded); and co-ordinates School-level EDI activities. These include six nominations to the Advance HE Aurora programme, events for International Women's week, Black History month, LGBT History month, the installation of an on-campus nursing room for nursing mothers, and maintenance of an EDI intranet with links to staff networks, policies and resources. The Unit has actively supported this agenda with a target to increase the representation of women within NTU's professoriate to 35% by 2022. Within the Unit, women now account for one third of all research staff and nearly half of senior research roles (professors and associate professors).

Recruitment across A&D has transitioned, through gender decoding of recruitment materials and mixed-gender interview panels, to attract a more diverse staff pool. Staff training improves knowledge and understanding of equality and diversity within the workplace and we have introduced essential unconscious bias training for all staff.

Staff perception of EDI issues is very positive. The results of the 2019 NTU Staff Survey showed that at least 91% of staff in A&D believe that the University is committed to equality of opportunity for all staff. Most staff report that the University respects people equally regardless of age, disability, gender reassignment, sex, sexual orientation, race or religious belief (all responses are between 95% and 97% positive). Overall, this highlights the Unit's commitment to support and promote equality and diversity among our staff.

NTU is working towards the Race Equality Charter. Staff equality and diversity are monitored through NTU HR data. In addition, PGR equality and diversity data are monitored through Doctoral School and M3C/M4C systems. BAME representation in research roles is a strategic

area of improvement, building upon existing strengths in professorial leadership (Dias) and the diversity of the ATRG where BAME researchers account for 38% of the staff team.

All researchers undertake Equality, Diversity and Inclusion training in line with NTU's Code of Practice for Research. Staff with responsibility for recruitment and research management undertake unconscious bias training. Equality and diversity events are held regularly within the Schools. For example, the International Women's Day and International Men's Day events held in the Bonington Gallery in 2019 and in 2020 with each event including talks, workshops and five-minute thesis sessions taking place over 5 days. There were 106 attendees in 2019 and 132 in 2020.

Staff on fractional contracts are considered equally when allocating research resources. This is particularly relevant where colleagues have a mature creative studio practice, (for example, Fine Art has 13 staff on various contracts ranging from 0.4 to 0.8 FTE). For part-time colleagues, the same incremental scales apply as to full-time employees. The University adopts uniform career progression principles from early-career researcher to professor to ensure that succession, retention, gender and diversity balance is achieved. By way of example, in the census period, two members of staff have agreed remote-working arrangements and two have received support for travel to conferences during periods of ill health and in the context of caring responsibilities.

As part of NTU's commitment to advancing gender equality, a funding scheme has been developed to support colleagues returning to academia following a period of caring-related leave. Support of Academic Returners (SOAR) provides financial support of up to £5,000 per instance of long-term carer's leave. For doctoral candidates and staff with caring responsibilities or for those suffering from ill health or who have protected characteristics (e.g., a disability); additional support for conference attendance, travel and for conducting research productively is also considered on a case-by-case basis.

A&D supports an open approach to seeking applications for internal research funding and for support with external funding, research-related promotion, conference attendance, sabbaticals and training and in considering outputs and portfolios for REF submission. This process forms part of the School's induction process for new research staff. Electronic Data Interchange (EDI) is used to provide data for active monitoring of balance in the A&D staffing plan. Using these data, a staffing group reviews balance on a regular basis in order to identify areas of underrepresentation.

3. Income, infrastructure and facilities

Research Income

Income for the census period has increased significantly by 198% and totals £6,782,816 (HESA returned).

During the REF2014 census period, the Unit's average income per year was £454,554 with an average annual research income per FTE of £21,749 from HESA returnable research funding sources. In the REF2021 census period the Unit average income per year was £1,130,469 with an average annual research income per FTE of £37,467 from HESA returnable funding sources. This is a significant increase on the previous census period. It rises further if the additional non-HESA funding is included; this funding has been considerable at £1,360,545 in the census period, coming from: Arts Council England; British High Commission, Cyprus; British Council, South Africa and India; Solovki State Museum, Russia; and Research England sources.

Staff have won numerous awards including from the Arts and Humanities Research Council (Twigger-Holroyd), British Academy (Hunt), British Council (Edwards), EPSRC (Dias), Innovate UK, Research England (Ford) and Leverhulme (Edwards).

The work of Dias led to a substantial EPSRC award of £1.4 million to develop new manufacturing methods that add electronic functionality to textiles. This was the largest UKRI grant awarded to date in the School and the largest EPSRC engineering design grant ever awarded to a school of art and design in the UK.

The work of Ford has brought £4.6 million funding from Research England (CCF) in partnership with De Montfort University and Brunel University (£1.14 million to NTU). This research supports New Product Development in the UK and builds on Ford's outstanding REF2014 Impact Case Study at his previous institution.

Infrastructure and Facilities

A&D staff are located in three buildings on the NTU City Campus in central Nottingham, adjacent to ADBE's buildings.

NTU has invested £250,000 in accommodating the Design Matter Group (Ford) with a facility to undertake design research for a wide range of companies. Furthermore, NTU has recently invested £23M (including £9m from D2N2 Local Enterprise Partnership) in the Medical Technology Innovation Facility (MTIF) which opened in late 2020; this will provide support for the work of Dias, Breedon and Ford in the next census period.

The ATRG has three research labs (textiles analytical equipment lab, flat-bed Stoll and Shima knitting lab, and flexural composite research lab) and extensive technical resources (FTIR, tensile testing, wearability parameter testing, etc.).

A&D houses NTU's Lace Archive, whilst the Design Matter Research Group has a centralised studio lab that houses equipment and other facilities (3D printing, laser scanning and cutting resources, etc.). Researchers from ADBE are housed in lab/studio facilities with extensive equipment including a Creative and Virtual Technologies (CVT) Lab, which is equipped with cutting-edge technologies including: visualisation technologies (augmented reality, mixed reality, virtual reality); tracking systems; HD video conferencing rooms; human computer interaction systems; audio devices; and BIM/3D modelling/rendering software. Technical teams support all these investments. In total across A&D and ADBE, during this REF period, £1.358m has been invested in infrastructure which has directly supported research.

PhD students are located close to the above facilities having extensive access to these resources. Students are located centrally in a dedicated workspace in A&D with access to NVivo, Python and other software, with appropriate IT support.

Strategic investment is ongoing with the £34 million investment in the new C3 Centre and a £12 million investment in A&D's current estate, including a Research Innovation Lab.

Research is supported by a newly-established University Research Operations team and a full research lifecycle information management system. This supports researchers with pre- and post-award activities. Details of this and the investment of over £1m are provided in REF5a. The research information system Worktribe provides a centralised source of research data. This stores research projects, outputs, impact and provides information for the management of grants. Worktribe further supports the Unit with an ability to include non-standard outputs. This provides greater transparency for the evidence that underpins this research, making it open for scrutiny and use by others. It makes for greater efficiency in data collection and through the proactive approach to data management it reduces the risk of inappropriate disclosure of sensitive data and serves to preserve a considerable amount of unique data.

NTU is currently one in a consortium of three universities delivering the Research England, IBbD project. This project provides access for numerous non-academic organisations to the facilities and expertise of three universities in undertaking a range of design-research projects nationally. This is being extended into a collaboration with the University of Newcastle in Australia between NTU's Design Matter Group and Newcastle's Fastlab.

In the census period, the Unit has benefitted from in-kind contributions in terms of formally recording the time invested by companies (estimated at £250,000 in the census period) to the Research England Connecting Capabilities Fund IBbD project in support of design research engagements. Furthermore, the ATRG has benefited from the donation of a state-of-the-art computerised flat-bed knitting machine from Stoll GmbH valued at £69,000, which has been modified by A&D staff to facilitate the production of novel knitted space antennae structures.

Unit members have collaborated with the refurbishment of the Nottingham Castle which has been supported by an NTU contribution of £250,000 towards the refurbishment of Nottingham Castle. The Lab is a room at the centre of the Castle's galleries which NTU will use for research, experimentation, play and performance; presenting interactive events and installations created by NTU's academics, students and partners, designed for the public and promoted by the Castle.

4. Collaboration and contribution to the research base, economy and society

The Unit's approach to embracing interdisciplinarity and to engaging with non-academic organisations is demonstrated by the strength of its impact case studies. They exist against a background of work that is deeply engaged with sector industries, from professional practice and commissioned artwork (ARC), to design consultancy (PIC), to R&D projects (DRC), and to policy contributions for government on sustainability issues and the protection of international heritage (F&TRC). Much of this collaborative work is externally-funded.

In addition to collaborating with industry, members of the Unit also work with government agencies. For example, the Sustainable Design and Consumption Research Group has collaborated with the Waste and Resources Action Programme (WRAP) and DEFRA on research projects to promote sustainable product and clothing consumption starting in 2013. Evidence from Cooper was cited by the House of Commons Environmental Audit Committee inquiry into the Sustainability of the Fashion Industry in its report to government in 2018.

The Fashion and Textile Heritage sub-theme led by Briggs-Goode has worked with several national and regional museums and non-academic companies, including the V&A and the Science Museum as well as Nottingham's Museums. This has led to a £70k HLF funded East Midlands Textile Heritage network involving a group of partners in the region in the oral history project, 'Textile Tales'. As is evident from the Impact Case Study, Edwards' work is founded on non-academic engagement, which led to Edwards being commissioned by the British Council to produce a report for the 2018-2021 project 'Crafting Futures India', as well as to ongoing work with international museums (Royal Ontario Museum, British Museum). This followed from Edwards' work in 2014 - 2017 on a British Academy International Partnership, 'By Design'.

Research based in art practice also generates non-academic links, such as Cocker's work with collaborators in Vienna, funded by the Austrian government's PEEK scheme, and Higgins' work with museums in Russia and Poland. Higgins' focus on research practice on Narratives of Place was the underpinning theme for the Cumulus conference in 2016, which Higgins chaired at NTU. Selby's, Maier's, Higgins' and Cocker's work illustrates the Unit's strong international dimension, which is also demonstrated by a significant group presence at the Venice Biennale in 2017 and 2019.

Other researchers have achieved notable non-academic collaborations in the period, including Townsend's work on fashion for older women, which drew on an existing participant group (2014 - 2017). In addition, Townsend's work in Guatemala to promote the integration of new technology into artisan textile production was supported by the Global Challenges Research Fund in 2019, whilst underpinning work, which informed the Guatemala project, was done with the local charity Emmanuel House on a student-led sustainable fashion initiative (2016-18). This initiative raised awareness of homelessness and clothing poverty (using donated clothing and textile waste). A similar ethic motivates Hunt, who is the PI on a British Academy funded research project 'Learning Aesthetics from People who are Visually Impaired', to work collaboratively with MySight Nottinghamshire since 2019. This work combines theory from sensory anthropology with user participation and involves students in an NTU-funded live project exploring and developing sensory designs by working closely with people who are visually impaired.

Collaborations with industry are evident in the work of the Design Matter Group. The Group's design research approach is typified by collaborations with Inspiration Healthcare Plc (2012 to 2019), Rober (2012 to present), BT (2014-2016), Sanofi (2016-2017), Versus Arthritis (2016 to

present), and Bacardi (2019). This work is growing internationally to include collaborations around new product development with the Industrial Innovation Centre (Muscat, Oman), Newcastle University (New South Wales, Australia) and the Hefeng Creative Square and Ningbo University (Ningbo, China).

The ATRG has collaborated with over twenty different industrial partners (including, notably, Oxford Space Systems) in the fashion, communications, medical, textile, and material sectors on projects ranging from intelligent protective work-wear through to innovative automotive components and to cutting edge smart garments. Other collaborators include UK Government Defence research bodies (DSTL and RCDM) (2016 to present). In addition, Fashion and Textiles is deeply connected with over thirty international partners who have included Khatri community block printers in Gujarat, the Ixchel Museum of Indigenous Textiles and Clothing in Guatemala, and the Elisseev Palace in St Petersburg Russia (2014 to present).

Engagement with community groups has centred on work on sustainable consumption practices, particularly repair, reuse and recycling in which members of the Unit have collaborated with both national schemes such as the 'Restart Project' and local initiatives including repair cafes.

The Unit's contribution to the academy, economy and society is further indicated by the award of fifteen prestigious international prizes, recognising the excellence of the research and practice. Notable among these are the Senior Researcher Prize for Best Paper IFFTI conference, Polimoda, Florence (2015), Textile Society of America R.L. Shep Award (2016) (for ethnographic study of textiles), Outstanding Peer Reviewer, Leonardo Journal, MIT Press, USA, (2017), United Nations Gold Award for Children's Book Illustration (2014).

The Unit actively supports researchers' engagement with academic conferences and more than twenty learned societies, including leading and chairing of PLATE, Product Lifetimes and the Environment, 2015, 2017, 2019; leading Cumulus in 2016; leading the DRS special interest groups and conferences in 2014, 2016, 2018, 2020, and leading the Art Forum, 11th International symposium on Display Holography at the University of Aveiro, Portugal. Papers have been given at the Society of Artistic Research (SAR) (2017, 18, 19, 20) whilst members of A&D represent NTU on the SAR executive (2017-20) and the Design Research Council.

Unit members contribute to the discipline through journal editorships including guest editorships of fifteen special editions such as Sensors 'Textile Electrodes and Sensors' and Critical Studies of Fashion and Beauty, 'Fashioning through Materials', 2014, editor of Leonardo Electronic Almanac 2014 - 2017 (MIT Press), and as Co-editor of Journal of Craft Research (Intellect). This work stands alongside the extensive contribution of colleagues to the academy through reviewing for over seventy-five journals, including for the Journal of Design Research, Journal of Cleaner Production, and the Journal of Cloth and Culture.

The Research Centres support colleagues in sharing their research insights in a variety of forms, which include project-specific events and dissemination workshops and taking advantage of University-wide project showcases. Unit members regularly make press and broadcast media contributions with over 130 in the census period. This media exposure is supported by the media office in supporting colleagues, for example, in preparing articles for The Conversation. Since 2015, 28 colleagues in this Unit have had articles published on various topics which have been widely republished in mainstream press including the Daily Mail, the Independent, Mashable, New York Magazine, New Zealand Herald and Scientific American. For example Hunt's article in 2016 about the colour of David Bowie's eyes, reached more than 1.7 million readers worldwide – the best read opinion piece in The Conversation by an NTU academic.

The media office also supports academics in preparing media releases, for example a 2015 release on research by Townsend on older men's experiences of fashion was published in The Times and a 2017 press release on Arm's work on creating artificial human bodies to help train surgeons was reported nationally and internationally on the Discovery Channel, Daily Mail, Daily Express, Daily Mirror, Metro, BBC News website, IFL Science, Forces TV, BBC East Midlands

Today, Radio 4's Today and Tech Insider. A video of the prototype shared on Facebook by Tech Insider was viewed more than 26 million times.

Centre websites and those of specific projects support dissemination of research activities. For example, ATRG's web presence has over 23,000-page views from Facebook and its WordPress website.

The standing of the Unit's researchers is indicated by fifteen staff who serve on UKRI and international funder peer review panels. This includes four colleagues who are currently members of the AHRC Peer Review College (PRC) one who is a member of the EPSRC College, one who served on a BBSRC panel in 2020 and two who have been members of the Horizon 2020 expert review panel. This contribution extends internationally to work with the Hong Kong Research Grant Council (2015 -2019) and the Norwegian Research Council (2018-2019).

The global reach of the Unit's research is shown by the number, quality, and geographic spread of leading institutions with which there are links, with over fifty having invited colleagues to speak about their work. These include the Design Museum, London, Design Ethics for a Complex World, 2019; Fleming Museum, Burlington, Vermont, USA, 2016; and Accra Technical University, Ghana 2017. Similarly, the intensity of practice-based research activity is shown by over sixty invitations to exhibit, including international exposure at significant venues such as the Venice Biennale; the National Gallery of Arts, Warsaw, 2017; and Bundesverband Kunsthandwerk. V. (German Arts and Crafts Association), Frankfurt (Germany) 2017. Furthermore, 34% of Unit's publications have international co-authorship.

Colleagues are recognised for their standing in their research disciplines as evidenced through twenty-four keynote presentations given at national and international conferences. Examples which demonstrate breadth are: *Reuse and the tolerance of consumers towards our throwaway culture*, PREUSE conference, Nijmegen, Netherlands, 21-22 November 2018; *Sustainable consumption and Product Design: Key pillars for a more circular economy in Europe*; *The New Circular Economy Package: What role for repairable and longer-lasting products*, European Environmental Bureau, the Repair Café Foundation and REUSE seminar, Brussels, 2 June 2015; and *Fashion Endured*, Redress Fashion Academy, University of South Australia, Adelaide, Australia, 20 September 2018.

Indicators of esteem include, a professorship at the University of Bergen, a visiting professorship at Newcastle University, New South Wales, Australia, external PhD examinerships both in the UK and internationally, and external PhD supervisions at other HEIs both in the UK and internationally (i.e., RCA, GSA, Aalto University, University of Bergen).