

<p><b>Institution: Loughborough University</b></p>
<p><b>Unit of Assessment: D34 Art and Design: History, Practice and Theory</b></p>
<p><b>a. Overview</b></p> <p>This submission encompasses the research activities of Loughborough Design School (LDS) and the School of the Arts (SotA). The Schools submitted separately to the Art and Design panel in RAE2008 with a total FTE of 65. The slightly reduced FTE for REF2014 reflects organisational restructuring and strategic selection of returned staff across the breadth of the field of Art and Design including History, Practice and Theory. The submission is designed to demonstrate excellence across the Unit's strengths in animation; art history and theory; design history, theory and methods; drawing and visualisation; ergonomics and human factors; fine art; inclusive and user centred design; material technologies and textiles; product design; sustainable design; transport systems design; visual culture, communication and production. Whilst there are overlaps of design concerns, each School has distinct strengths: the Design School's largely reside in social and industrial applications, whilst the School of the Arts' lean towards more critical and discursive practices. The research agenda is driven and managed separately within each School by their respective Senior Management Teams and operational structures and, in this respect, they are distinct. The Unit benefits from broadening the scope of the discipline through embedding staff with backgrounds in, e.g. physiology, psychology, and engineering, into a community of art and design researchers. This submission is therefore broad, including significant activity that crosses disciplinary boundaries through close collaboration with those outside of Art and Design. LDS' recent award of the AHRC <i>Design Star</i> DTC secures collaborative PhDs beyond 2020.</p> <p><b>b. Research strategy</b></p> <p><i>Development and investment since 2008:</i> Loughborough University has made significant investments in Art and Design staff and infrastructure since the last RAE and this is already delivering with our largest ever PhD student community and the Unit sustaining and expanding its research income portfolio. A core strategic aim since 2008 has been to invest in the combined research excellence in Design and Ergonomics that had previously been distributed across different University departments. In RAE 2008, the Design and Technology (D&amp;T) and Ergonomics and Safety Research Institute (ESRI) submission to 'Art and Design' was the highest rated of any submission to the panel; the Department of Ergonomics was included in the highly rated Loughborough Engineering submission to UoA28 (Mechanical, Aeronautical and Manufacturing Engineering), the largest submission to that panel. In 2010, D&amp;T, Dept of Ergonomics and ESRI merged to form Loughborough Design School (LDS). LDS has a uniquely inclusive view of design, underpinned by rigorous data, collected and analysed in collaborative and cross-disciplinary research. This is reflected in the diversity of research groups, disciplinary backgrounds and outputs in the School. New research groups now include co-members who were previously working in different faculties, and have facilitated fresh cross-disciplinary research work including co-investigation on funded projects, co-authoring papers and co-supervision of PhD students. LDS actively seek to challenge the scope of Design disciplinary boundaries by including the vital research that directly feeds into product development (e.g. a car crash investigation team; a physiology lab). The breadth of expertise provides a thread from science to manufactured products, e.g. pure research in thermal physiology has been used to develop performance clothing designs that have subsequently been evaluated in our laboratories and then developed into commercial products (e.g. Adidas, Decathlon).</p> <p>Demonstrating contrasting aspects of the Unit's research, SotA sustains a vibrant research culture, which has benefited from infrastructural enhancement through the development of five aligned technical 'hubs' and strategic initiatives aimed to advance established excellence in animation, and art and design history, progressive developments in multi-disciplinary approaches to drawing, visualisation and 'politicized practice', whilst enhancing emergent research and critical expertise in textiles and visual culture. A significant development has been the forging of interdisciplinary collaborations across the University, with other institutions, internationally and outside academia. Four firmly established research groups facilitate much of this work, whilst allowing flexibility for the support of significant individual research in history and theory. Research characteristically inserts an influential theoretical platform for applications of art and design practices by progressing</p>

discourse in their socio-political and historical contexts. It advances innovation through its five initiated journals, which have consolidated reputation in: British and global animation initiatives (archiving, scriptwriting, documentary production); progressive advocacy of drawing and visualisation (interrelationship between digital interfaces, materiality and communication); debates concerning art, politics and the public sphere (feminist aesthetics, environmental aesthetics, regenerative public art, radical political formations); formative research in textile design and practice (materials, processes, new technologies); models of theory and practice in the engagement with visual culture (re-addressing post-structuralist, post-colonial, feminist and global forms of practice). Since 2008, SotA has: disseminated research widely through high-impact publications (34 books, 86 chapters, 79 refereed journal articles, 86 conference contributions, and over 100 exhibitions); diversified external research income; and established a growing cohort and international reputation for postgraduate research, particularly practice-based.

University investments in Art and Design infrastructure have concentrated on improvements in facilities, including a £21m building. The building comprises teaching, laboratory, studio and office space. A second significant investment comprised £1.3m to develop state-of-the-art dedicated ergonomics laboratories. Developing its strategy to strengthen the arts, the University's contemporary arts centre RADAR <http://www.arts.lboro.ac.uk/radar/> has embedded its unique programme of high quality artist's commissions that respond to campus-based research. In 2011, RADAR moved into bespoke premises on the SotA site facilitating collaboration such as the *Questions of Value* project with the Unit's Politicized Practice Research Group (2012-13).

*Interdisciplinary initiatives:* The Unit generates and sustains a culture of interdisciplinary collaboration, much of which has spun out of Unit-organised events in the areas of Sustainable Design (Harland, Lilley), Visualisation for Service Design (Lo, Jun, Mitchell, Porter), Public Communications (Lo, Jordan, Southee), Experiential Knowledge 2013 Conference (Design Research Society EKSIG; Evans, Nimkulrat) and Visualisation (Downs, Marshall, Selby). The Unit benefits from the advantage of access to networks for interdisciplinary development and across the University; from Chemistry to Politics, Engineering to the Social Sciences and Sports Physiology. Across campus the Unit is working with colleagues on a number of projects, 10 of which have been awarded EPSRC Bridging the Gaps funds: e.g. the project 'Methods for producing electromagnetic rays in fabrics', with the School of Electronic, Electrical and Systems Engineering, extends wireless communication devices by developing flexible fabric screens that include electronics components. The results of such interdisciplinary initiatives will form the basis for high quality funding bids and internationally relevant publications over the next five years which have already delivered on cross-University EPSRC Doctoral Training Centre bids. Cross-institution working has been a key strength which has underpinned our success in generating funding, evidenced by the Unit holding collaborative grants and awards with all 8 of the other Schools at Loughborough University since 2008. E.g. collaboration with Civil and Building Engineering led to 6 research projects with a total value of £4.3m (combined University figure). This approach allows for development of significant long-term relationships with partners to grow from small 'enterprise' (consultancy) projects. E.g. Adidas (Germany) and Oxyane (Decathlon, France), have funded seven PhD students and associated research projects following on from small enterprise collaborations. Similarly, an enterprise project with Nissan (Japan) developed over 5 years into a current collaboration comprising 2 PhD students and concurrent research projects in 3 distinct areas of vehicle design.

*Funding:* Our research comprises activity for government and industry, as well as substantial enquiry-driven research funded by Research Councils. The combined value of grants awarded from Research Councils, government agencies, industry, charities and the EU during the period 2008-2013 is over £10m, with the size of individual grants allocated to the Unit ranging from less than £10,000 up to £2.3m (On-The-Spot, DfT). The breadth and nature of our research income is indicated for each research group below. The Unit operates procedures of formal peer review to evaluate proposals prior to submission and is supported by the centrally-funded University Research Office which provides administrative support and financial co-ordination, and Enterprise Office on collaborative agreements for working with industry.

The University, in line with its strategic plan 2016, has significantly increased its research funding

since RAE 2008. It has achieved this through commitment to outstanding researchers in key academic fields and through providing an infrastructure that supports academic endeavour. The University will sustain this success in the future by building excellence through growing capacity and influence (e.g. Loughborough University has committed to significant expansion via a London campus, which will include a design theme when it opens on Olympic Park in 2015).

*Future strategic aims:* Moving forward to 2020, the University has established a strategic framework for research development designed to ensure a dynamic and sustainable infrastructure and to focus investment on cross-institution strengths that reflect external global challenges. In its commitment to sustaining and diversifying this research, the University has appointed 6 academic leaders and associated professional support staff with the remit to drive initiatives within each of the 6 Loughborough University research 'challenges' (Changing Environments and Infrastructure; Communication, Culture and Citizenship; Energy; Enabling Technologies; Health and Wellbeing; Secure and Resilient Societies). Each challenge has synergy with strengths in the Unit and is designed to dovetail with current and emerging research priorities including those identified by AHRC, EPSRC, TSB and Horizon 2020. They will support opportunities to contribute applications of art and design and help to synergise efforts across the breadth of the Unit's research in the next five years, focusing support for doctoral training and studentships, and funding applications. E.g. the Unit's contribution to 'Communication, Culture and Citizenship' will include a combination of cultural production and the development of theoretical and critical perspectives to examine culture's role in generating community cohesion, place and identity. Research within this theme will amplify the contribution of visual culture through art, design, language and understanding, manifested in direct public engagement, and through practices that deliver both on public service impacts and assist the development of civil society (such as applications of animation processes for social benefit). This complements the Unit's track record and plans in, e.g. sustainable design (e.g. one recently funded £5.3m project, i-STUTE, across four Universities running to 2018 will determine citizen acceptance of energy storage solutions for domestic and industrial applications). The Unit will explore opportunities offered by 'Enabling Technologies' for the development of visual practices in commercial production and exhibition contexts, and of materials technologies research investigating, e.g. how 'textile thinking' can inform the development of new sustainable materials for design-led functions (<http://ttsm.lboro.ac.uk/>), and the combination of traditional photographic processes and digital print technologies using noble metals. The Unit's expertise in additive manufacturing for healthcare aligns to both 'Enabling Technologies' and 'Health and Wellbeing' and is being invested in. E.g. expertise in personalisation of prosthetics and customised single-use surgical tools is being strategically supported through new academic staff being recruited for Jan 2014 to facilitate expansion and development of this field. The Unit are one of 5 academic partners in the AHRC 'Design Star' CDT which will steer a collaborative approach to PhD student provision for those embarking on doctoral studies from 2014-2018.

*Intellectual infrastructure:* Research Groups provide the structure in which research activity, collaborative developments and funding applications are managed and supported. Each has regular meetings and seminars, and encourages collaboration. Academic staff align their research with one of the research groups.

The Animation Academy's (AA, SotA) research promotes animation as a radical art-form and cross-disciplinary application. Significant for its relationship with professional bodies, it has steered: animation history, scriptwriting and archival research in collaborative exchange with Pixar, LAIKA, Fox TV; curatorial initiatives with Estonian, Norwegian, Australian research councils; and Festival partnerships including HAFF, Utrecht; WFAF, Varna; Animated Dreams, Tallinn; Anifest, Teblice. It has recruited additional expertise in the applications of animation within social and health contexts (Hani). Research has advanced theories of practice in the fields of Animation and Film Studies, evidenced by monographs and film production (Wells, Selby, Bolewski). In 2011, AA introduced the Intellect journal, *Animation Practice, Process and Production*. Since 2008, the group has prioritized development of British animation historiography and, with its partners (BFI, BAFTA, National Media Museum, Bradford) has formed the Association of British Animation Collections (ABAC) to create an infrastructure for British animation archives. LU's collection facilitates research, documentary production, curatorial projects for Festivals, Exhibitions such as *Watch Me Move: the Animation*

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*Show*, and collaboration with archives worldwide. AA attracts funding from bodies such as Danish Film Council, European Art Research Network and Netherlands Institute for Animation Film.

The Drawing and Visualisation (D&V, SotA) Group significantly contributes to the international research agenda by: questioning drawing knowledge, cognitive process and visualisation and CGI applications through the peer reviewed journal *TRACEY: drawing and visualisation research*; additions to its series of I.B.Tauris publications (*Hyperdrawing*, Marshall, Sawdon, 2012, and *Through Drawing*, 2014); consolidation as a centre for drawing research, including e.g.: 'Visualisation of Specific Experience'; 'Phenomenology and Drawing Practice'; 'Drawing: Serialised Graphic Narratives'. Since acquiring management of the Drawing Research Network (DRN) in 2011, it has progressively advanced its agenda by introducing global inclusiveness and peer reviewed submissions at its annual conference, commencing with *Drawing Knowledge* (2012).

The Politicized Practice Research Group's (PPRG, SotA) focus is the relationship between the political and art, design and theoretical production. It has advanced research by: establishing two Intellect journals, *Art & the Public Sphere* and *The Poster: Journal of Visual Rhetoric in the Public Sphere*; consolidating its reputation as a research centre for independent curation, art and aesthetics; attracting funding for AHRC development (*Socio-artistic communities*) and EPSRC Bridging the Gaps (*Public communications*); and convening themed seminar series. *Questions of Value* (Jordan) includes: 'From Commons to Communomics' (2012) and 'Art, Value and Price' (2013). The *RadicalAesthetics-RadicalArt* project (Tormey, Whiteley) explores the meeting of contemporary art practice and interpretations of radicality through its book series (Bloomsbury) and events e.g.: 'Radical Footage: Film and Dissent' (2012); 'Art, Politics and the Pamphleteer' (2013). SotA's political focus is extended by the recent emergence of the research group *Sexual Politics*. This consolidates established research in feminist art history, theory and practice (Arnold, Meskimmon), collaborative projects e.g. the international network *Lens of Empowerment* (2009-12), its conference and forthcoming anthology: *Home/Land: Women, Citizenship, Photographies*.

The Textile Research Group (TRG, SotA) examines the combination of craft processes with technologies such as laser processing and electronic textiles. It prioritises investigation of unique knowledge gained from textile practice leading to collaborations in commercial design, social contexts, and sustainability. Since 2008, it has added expertise by recruiting three researchers (Kane, Nimkulrat, Philpott). It advances debates by: convening international conferences (*Cutting Edge: Lasers and Creativity*, 2009, *Textiles Research in Process*, 2011); establishing the *Journal of Textile Design Research and Practice* (Bloomsbury) in 2013, with UK and US editors. It has attracted funding from: EPSRC Bridging the Gaps 'Methods for producing Electromagnetic Arrays in Fabrics' and 'Textile Thinking for Sustainable Materials'; Materials and Design Exchange SPARK award with industry for 'Heritage Cashmere and Laser Processing'; AHRC for 'Laser Enhanced Biotechnology for Textile Design' with De Montfort University and Collaborative Doctoral Award in collaboration with the Society of Dyers and Colourists.

The Design Practice Research Group (DPRG, LDS) comprises 13 academic staff with expertise closely associated with new product development. Research focuses on the 4 thematic areas of digital modelling, emerging technologies, user-based product development and the design process. In addition to dissemination in academic journals, a distinctive feature of DPRG is the scholarly use of design practice to support data collection that results in the embodiment of research findings as designed outcomes: e.g. surgical implants/prostheses (Bibb: Morriston Hospital), stab-proof textiles (Bingham: EPSRC), inclusive cutlery (Torrens: Nottingham Rehab Supplies Ltd), textile energy storage (Southee: EU FP7), and a smartphone text interface (Page: Swiftkey). Impact also occurs through international patents (Torrens: wrist splint; Bingham: under-wired brassiere); competitions (Evans: International Design Excellence Awards); exhibitions (Campbell: Beijing Design Resource Centre; Bingham: Object Gallery, Australia); design tools (Evans: Royal Academy of Engineering/Industrial Designers Society of America).

The Environmental Ergonomics Research Centre (EERC, LDS) focusses on the interaction of people with their physical environment (workplace, noise, vibration, vision, lighting, climate, clothing), providing design guidance to industry (products, equipment, vehicles, clothing and

buildings) based on empirical and theoretical research. The Group sustains a prominent position in their respective scientific fields through publication of fundamental work (over 100 journal papers by 7 FTE in the REF period). EERC's funded research co-operations range from SMEs to large international organisations such as Adidas (physiological basis for sports clothing design), Nissan and Caterpillar (seats and vehicle cab design), Google and NHS (applied vision), ArjoHuntleigh (healthcare equipment) and WAS (ambulance design). Research across EERC has informed new government guidelines and ISO / EN standards, e.g. vibration in power tools, evaluation of hot/cold workplaces, design of climate systems, computer monitors, patient handling, 3D stereoscopic displays, medical imaging, drug labelling and design of acute hospitals and ambulances. Two examples of impact of EERC work are provided with the impact case studies.

The Sustainable Design Research Group (SDRG, LDS) builds on over 20 years of research and was established in 2009 with 2 academics. The group has grown to 6 academic staff, 3 post-doctoral Research Associates and 13 PhD students making it the largest of its kind in Europe. The strategic aim of SDRG is to enhance knowledge regarding integrating sustainability into design through five inter-related areas of interest: products, services and systems; people; strategy; methods and tools; and education. Collaborative research involves many well established industrial partners such as Alliance Boots developing sustainable refillable packaging systems; Philips and Formax on closed loop emotionally valuable e-waste recovery; Eon on using design to reduce energy consumption in the home. During the assessment period there has been over £900k of research funding awarded to SDRG.

The Transport Safety Research Centre (TSRC, LDS) is world-leading in bringing real-world approaches to the reduction of traffic casualties and the mitigation of transport impacts. With over 260 publications since 2008 the team is world-leading in studying causation of accidents and injuries, and partnering with manufacturers and road engineers to improve the design of vehicles and roads. TSRC includes an on-site crash investigation team that works with the emergency services and instrumented vehicles for measuring driver behaviour. Since 2008 projects have included On-The-Spot (£2.3m Department for Transport (DfT)), Co-operative Crash Injury Study (£1.9m DfT) and currently RAIDS (Road Accident In-Depth Study; £1.9m DfT). This work has provided the basis for the development of the European Road Safety Observatory (€2.5m EC) which, with the TRACE project (Traffic Accident Causation in Europe; €350k EC), provides essential information for safety policy-makers and has now been adopted by the EC. Other major projects have included TeleFOT (Field Operational Tests of Aftermarket and Nomadic Devices in Vehicles; £1.1m EC) in which the design of satellite navigation devices was evaluated through on-road driver trials. The mobility needs of older public transport users are being explored under a current project funded by the MRC (£250k).

Design Ergonomics (DE, LDS) has been developed, sustained and defined at Loughborough for over 50 years and continues to mature. The research group comprises 16 senior staff returned in this submission. The remit of the group is to embody ergonomics within design of products and systems. The scope ranges from human factors in complex socio-technical systems, through to person-product relationships and user-centred design, placing people's needs at the heart of the design process. Since 2008 DE's research has delivered high profile outcomes including the Gates Foundation award-winning project '*Re-inventing the Toilet*' delivering safe, affordable and sustainable sanitation for the developing world and, working with the Olympic Delivery Authority throughout the construction process, '*Preconditioning for Success*' capturing the human and organisational factors leading to the excellent health and safety record of the Olympic Park construction programme, the first ever Olympic construction project with zero fatalities. The group combine research strengths in digital human modelling (3D modelling to perform virtual assessments of products and workplaces) and experimental work in several domains including vehicle design, and in ageing, disability and health (inclusive design and accessibility). Vehicle design research has e.g. enabled the development of a new European standard on HGV mirrors to remove a blind spot that has been a causal factor in cyclist fatalities and motorway side-swipe accidents; designed the first UK national Police vehicle livery (an impact case study); designed new vehicle layouts for Nissan. Using an interdisciplinary approach, collaborating cross-University, the group explore the contribution of user centred design to technology development, engineering

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and social science, particularly in the area of energy, with over £5m of research projects awarded in the REF period (total Loughborough University figure) with significant industry involvement and impact (e.g. Eon <http://www.calebre.org.uk>). The group has strengths in inclusive design (e.g. development of wearable simulations to allow designers to empathise with user abilities; digital modelling of, and for, vulnerable users). Research into human factors in complex socio-technical systems addresses interactions between people, products, technologies, services, policies and culture. Application ranges from healthcare service design and patient safety, to design, safety and usability of the built environment. The project '*Creating Integrated Care Pathways for Safer Medicines Management amongst Older People*' (funded by Islington Clinical Commissioning Group) aimed to improve medicines management for people in the community by understanding the overall impact of the service design around patients' needs; working with the NHS '*Electronic Patient Information Crossing Organisational Boundaries*' identified failings in electronic information sharing amongst Healthcare Professionals and the care of vulnerable groups which resulted in service design changes including the redesign of electronic patient record systems. The current research portfolio includes funding from government, charities and industry and provides the foundation for DE research into the future.

**c. People, including: I Staffing strategy and staff development**

*Developing our human capital:* The Unit has responded to staffing changes and new opportunities by making appointments in prioritised areas for strategic development such as ergonomics (Fray, Jun), sustainable design (Escobar-Tello, Lilley), future technologies (Bohemia, Southee), additive manufacturing (Sinclair, Bingham), animation (Hani), textiles (Kane, Nimkulrat, Philpott) and visual culture (Barnard, Bohr, Lo); by recruiting high-calibre researchers at an early stage in their academic careers (9 ECRs returned); by encouraging staff development training; by encouraging internal promotions; and by being proactive in ensuring a growth of postgraduate numbers.

Loughborough University is committed to achieving equality for all, including mandatory recruitment and selection training, which embeds Equality and Diversity policy. The University is a member of the Athena SWAN Charter for Women in science, which recognises commitment to advancing women's careers in STEMM academia (<http://www.athenaswan.org.uk/content/athenaswan>), and the Design School is in the process of applying for Silver status. The Unit's academic staff have a 46%/54% female/male split. In 2009/10, Loughborough University undertook a comprehensive analysis of its alignment with the Concordat to support the Career Development of Researchers, and published an implementation plan in 2010, for which it received the EC's HR Excellence in Research Award. The plan was updated in 2012, as part of an internal review for the HR Excellence award. Specific outcomes from the plan include a continuing commitment to a University-wide Research Staff mentoring scheme, a revised Code of Practice for the Employment of Researchers, and establishment of the Loughborough University Research Staff Association. Monitoring takes place through participation in the Careers in Research Online Survey, and through the 2012 University-wide Staff Survey, for which the Unit Research Job family had the highest number of 'green' (best) categorised responses (10% above the institutional average).

*Infrastructural support:* At School level, Associate Deans for Research and Enterprise provide strong infrastructural support for a research culture aligned with both the traditional academic enquiry-driven research and that driven by the needs of society and industry. Research Committees, comprising representatives from each of their research groups and centres, take responsibility for research strategy and oversee the allocation of internal funding. Academic and research staff and students can apply for funds towards research expenses and conference attendance (representing, on average, 8% of non-pay budget). Further funds are allocated to priorities identified on an annual basis. Conferences and symposia held on campus are supported by the Unit such as the Design and Emotion UK Chapter launch, and the Design Research Society International Conference on Experiential Knowledge (2013), co-organised by colleagues from each School (Evans, Nimkulrat), as was the Drawing Knowledge DRN International Conference, 2012.

*Supporting career development:* Optimisation of Research performance is a key cross-University priority, and all academic staff complete an annual Personal Research Plan (PRP), discussed with a trained senior colleague, comprising targets for research dissemination, funding, research student progression, and esteem-related activities. This process facilitates identification of areas

for staff development, embeds research in performance monitoring and reward systems and is monitored by the University's Research Performance Monitoring Committee, chaired by the Pro-Vice Chancellor for Research (PVC(R)). All staff have an annual Performance and Development Review, a 1-1 with a trained senior member of staff. Staff are eligible to apply for one semester of research leave in every eight semesters worked. Since RAE 2008 9 established contract research staff were re-graded and transferred to open ended Lecturer (2) and Senior Lecturer (7); a further 23 staff were promoted including 5 to Professor, 5 to Reader, and 13 to Senior Lecturer.

The staff development strategy includes Leadership and Management, and programmes accredited by the Institute of Leadership and Management have been completed by staff, including PIs and research staff. Research staff also attend courses run by the Graduate School, Careers and Employability Centre, and Staff Development. Early Career academic staff undertake the New Lecturers Course, which included introducing University Research Culture and support available from the central Research Office. Probationary staff are mentored and have a reduced teaching load for three years to allow more opportunity for research. Mentoring by academics is also available for research staff. In 2011/12 Research Staff and early-mid career Lecturers were eligible to apply to participate in the EPSRC Developing Future Research Leaders programme. Staff from the Unit (Jordan and Southee) directly benefitted from this leadership development grant, dedicated coaching, participation in Action Learning and 360° Feedback.

Staff work directly with business through the wholly-owned company Loughborough University Enterprises Limited (LUEL) and the Enterprise Office. Non-academic organisations are able to second staff to the University; since 2008 the Unit has hosted visitors from Bridgestone (vehicle seating, Japan), Oxyane (sports equipment, France), SEAT (motor vehicles, Spain), Pixar Animation Studios and Aardman Animation, who have collaborated in research. The Unit has also hosted academic visitors from Universities in Australia, Finland, Canada, China, Indonesia, Sweden, USA including a Fulbright Scholar from the University of South Florida. Post-doctoral researchers are encouraged to exploit their knowledge through the Enterprise Project Group or become members of 'The Studio', a new route for creative graduates to generate enterprise and develop sustainable businesses <http://www.lboro.ac.uk/thestudio/>

*Mechanisms for maintaining standards of research quality and integrity:* The Ethics Committee advises on ethical matters arising in the conduct of University business and ensures that research is ethically responsible. The Ethics Approvals (Human Participants) Sub-Committee ensures that all work involving human participants meets required ethical standards. The Research Misconduct and Whistle-Blowing Policy and Procedure provides a conduit for reporting issues of research misconduct without fear of recrimination, ensuring a culture of research integrity.

## II Research students

*Growth in numbers:* Postgraduate research is strategically important for its contribution to the vitality of the research culture as a whole and has increased significantly across the Unit in terms of numbers and the visibility and reach of its activity. Since the 1st January 2008 the Unit has had 81 PhD and 13 MPhil completions. In addition to studentships being funded through external awards (including AHRC and EPSRC), the University supports studentships via the Graduate School (24) and directly as scholarships through School funds (29). In addition, studentships are strategically co-funded (50/50) with industrial partners as a way to strengthen relationships and prime future fully funded research projects. Students actively contribute to the research culture by initiating and hosting research events.

*Infrastructural support:* The University offers a wide range of support facilities for postgraduate research students, including the Student Advice Centre, Research Student Office, Maths Learning Support Centre and English Language Support Unit. The Graduate School (GS) works closely with internal services such as the Library and the Careers and Employability Centre, which provides a specialist service for researchers offering individual career consultations and an annual event for students to network with employers. The GS has a conference fund to support student attendance at national and international conferences. In addition, the Unit provides funding to support student attendance at conferences and to cover some research costs. The University is committed to

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achieving a work environment that provides equality of opportunity and freedom from discrimination that informs its admissions policy. Applicants with disabilities are invited to identify any special needs or support requirements they may initially have and are subsequently supported through the University's Counselling and Disability Service. The Dean of the Graduate School oversees quality assurance including admissions, examinations and appeals, ensuring equitable treatment, and a cycle of regular research degree programme reviews, which are reported to Research Committee. Within Schools, quality assurance is overseen by Associate Deans for Research who are members of the University's Research Committee (chaired by the PVC(R)). Procedures for admission require that a candidate has a postgraduate Masters qualification or equivalent experience; decisions on admission are taken by two members of staff and interviews conducted, often by Skype for international students. Two supervisors are allocated to each student, taking account of research expertise, workload and supervisory experience, benefitting both students and early career staff. Directors of Research Degree Programmes and Research Administrators monitor and support supervisory arrangements. Student progress is monitored through supervisory meetings held at least monthly. Annual re-registration requires satisfactory progress review of a significant piece of written work and an interview with an independent reviewer. The University participates in the Postgraduate Research Experience Survey (PRES) thereby gaining useful student feedback, which can be benchmarked nationally.

*Training and postgraduate research experience:* The GS is responsible for the delivery of transferable and employability training to meet the requirements of the Researcher Development Framework, and co-ordinates a comprehensive training programme that includes induction days, workshops, annual research conference and poster competition. The Schools provide more specific training where needed. E.g. students undertaking 'practice-based' study are supported by focused discussions of methodologies. A scheduled programme of guest speakers and workshops provides opportunities for students to present work in progress to fellow students and to experience other approaches. Seminar titles have ranged from, 'Radical Aesthetics: Critical Dialogues in Contemporary Art/Practices', 'Art and the Public Sphere: Contemporary Art and Urban Geography', to 'Protection of Occupants in Far Side Impacts', and 'Integrated control of heat loss responses during exercise in humans', 'Geometrical Freedom of Laser Sintering'. Postgraduate researchers are integrated within and actively contribute to the research culture through research group membership and have an input into research policy decisions through representation on committees. The annual 'DesRes' Design Research Student conference, attended by staff and students and open to visitors, requires first year students to present a poster, and second and third year students to give oral presentations. Prizes are awarded for best posters and presentations. Students are encouraged to take opportunities to carry out part of their research in partner laboratories. E.g. Japan Society for Promotion of Sciences (JSPS) summer programme enabled a student to conduct research at government laboratories in Tokyo and at Kinki University in Osaka (2010), and student practice is promoted in curated programmes of Animation at festivals and conferences (e.g. International Film Festival for Children and Youth, Zlin; Cinekid, Amsterdam; Haein Art Project, Korea). Students are encouraged to self-initiate events and curatorial projects including: collaborative seminars with other institutions (Chelsea College A&D (2010); Oxford University, UWE, Manchester Met University (2013)); 'New Research Trajectories' collaborative project with Nottingham University (2010; AHRC *Beyond Text*); two day international conference *Interrogations: Creative Interdisciplinarity in Art and Design Research*, 2009 (AHRC Collaborative Research Training with De Montfort University); 'Association of Art Historians' Student Conference' (2011) organized by the SotA candidate chair of AAH Student Group.

*'Design Star' AHRC Centre for Doctoral Training:* The Unit are partners with Reading, OU, Goldsmiths and Brighton on the £2.2m AHRC *Design Star* CDT. With matched support from all partners, this will fund a total of 60 PhD studentships with intake from 2014-18, thus providing a well-supported and guaranteed student cohort beyond 2020. The CDT will be inter-disciplinary and collaborative, as each student will have a supervision team including 3<sup>rd</sup> party supervisory monitors from other consortium institutions, and will participate in cross-CDT training and development, and a shared online Virtual Research Environment. Non-academic partners in the CDT will provide varied opportunity for placement and collaboration and include an NHS Trust, a local council, Microsoft and Intel, V&A and the Design Museum, Monotype and Maybourne Architects.

Placements will be supported by the Student Development Fund. Non-*Design Star* research students will also have access to its training courses, workshops, and conferences

**d. Income, infrastructure and facilities**

Since 2008, Loughborough University has invested £23m in infrastructure and facilities for the Unit. The majority of this comprises two major projects: the Design School building and Environmental Ergonomics Research Centre (EERC). The Design School building opened in 2011 includes 7920 m<sup>2</sup> of innovative teaching and lecture space, workshops, offices, research laboratories, design studios, computer and prototyping suites, a cafe, and areas for display and interaction. The majority of LDS is housed in the building; purpose-built studio and exhibition space is occupied by SotA. The building won 2012 Royal Institution of British Architects RIBA Regional Client of the Year Award, RIBA Regional Sustainability Award and RIBA Regional Building of the Year Award; it also won the 2012 ProCon award for Building of the Year and the FX award for Workplace Furniture. The building achieved a BREEAM Excellent rating, meaning that it has excellent sustainability credentials. Research laboratories include dedicated space for a 3D body scanner, a visual perception lab in which the spectral content of lighting can be manipulated, a vehicle lab in which six vehicles can be prepared or tested simultaneously, a driving simulator, DReAM lab (Design Research in Additive Manufacturing) and multi-purpose laboratories that can be booked for user trials, focus groups, prototyping, etc. Studio space incorporates motion capture facilities. Workshops and laboratories include capability for fabrication in a variety of materials. A further investment of £250k in SotA's refurbished technical hub facilities has included enhancement of the stop-frame animation area, the addition of high definition cinematic and large format digital and analogue cameras, 3D digital printing, and a continuous lighting and high definition video system with bespoke hi-glide tracking to the motion capture system.

The EERC had a £1.3m refurbishment and was opened in 2010. This centre includes over 400m<sup>2</sup> of laboratories, preparation areas, and research staff and student offices. Laboratories incorporate a combined stressor suite, where people can be exposed to extreme heat or cold, combined with low oxygen levels to simulate altitude, noise and different lighting conditions enabling the study of the performance of clothing and equipment design, as well as basic studies to create design guidelines for clothing and equipment for extreme environments. This suite incorporates a pair of chambers such that transient effect of moving from one environment to another can be studied (e.g. simulating entering buildings or transportation), or more than one trial can be conducted concurrently. A third large thermal chamber allows for temperature control. Further facilities include a wind tunnel in which, combined with one of two £100k thermal manikins, the technical performance of clothing can be studied. Additional facilities include two motion laboratories (one of which incorporates a driving simulator) in which seating and vehicle design is studied, and a suite of vision labs used for fundamental and applied visual research, including the design and user interaction with 3D television and cinema. The EERC laboratories are used in collaboration with industrial partners for test and evaluation of prototype designs of clothing, parts and equipment, and with other research groups including Loughborough University's Sports Technology Institute and the School of Sports, Exercise and Health Sciences (both submitted to other UoAs).

The Unit has developed several unique research tools in-house and these facilities are exploited commercially. These include physical (e.g. SKInS, sweat mapping) and digital (e.g. SAMMIE, Evoshape) tools. SKInS (Sensory and Kinaesthetic Interactive Simulations) are wearable suits that can provide designers with a realistic impression of another person's experience, particularly if they have a disease, disorder or disability. EERC developed a unique sweat mapping procedure that enables the development of targeted clothing insulation and breathability. The SAMMIE system is a Digital Human Modelling tool developed by Loughborough designers and engineers since the 1980s which is used and optimised via digital design research projects. The recently developed EvoShape is an innovative CAD tool that generates and evolves original styling concepts.

In addition to the income identified in REF4b, the Unit's research attracted over £1.8m directly from charities, trusts, public sector agencies (UK and abroad) and corporate sponsors. This has included £420k from government departments (e.g. DfT), over £430k from industry (e.g. Nissan, Adidas, Toyota, AECOM, and Decathlon (Oxylane)), £148k from UK Defence Science and Technology Laboratory (DSTL) and £77k from independent vehicle research groups (e.g. TRL,

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MIRA, Thatcham), over £173k from charities and bodies such as the Arts Council; British Council; Daniel Roberts Foundation; VAF (Brussels); Industrial Design Society of America; Japan Foundation; Visual Audio Fund, Brussels; Paul Mellon Centre; Ministry of Culture, Poland. Over £84k was provided to researchers through institutions such as the Academy of Media Arts, Cologne; AC Institute, New York; Gothenberg Institute, Sweden; SMART Project Space, Amsterdam; Victoria College of Arts, Melbourne; Zurich University of the Arts. Public or corporate sponsorship or commissions accounted for over £400k and includes Eddie Stobart Group; LAIKA films; Santander Bank; SEAT; Spring Energy, Norway.

**e. Collaboration or contribution to the discipline or research base**

This Unit's contribution to an extensive range of disciplines across the art and design spectrum is likely to be one of the most extensive in the country. As an example, involvement in different discipline associations ranges from the Institute of Ergonomics and Human Factors to the Association of Art Historians. The Unit has members in over 20 separate **Professional and Subject Associations**, each playing a role in shaping intellectual and development agendas.

**Recognition:** recognition of the Unit's important contribution is evidenced by **leading positions** held during the review period: Appointed as an Output Assessor for Research Excellence Framework 2014 Panel D34 (Art and Design: History, Practice and Theory) (Bhamra); Design Research Society: Executive Council members (Bhamra, Bohemia); Convenors of ISO (International Organization for Standardization) Standards Committees (Mansfield, Parsons); President elect of the Institute of Ergonomics and Human Factors (Haslam); Chair of European Society for Protective Clothing (Havenith); Presidency of the Royal Society of Portrait Painters (Adams); Secretary Fashion & Textiles Subject Association steering group (Walton); Chair Association of British Animation Collections (Wells); Association of Art Historians Executive Committee member (Whiteley); International Committee member of Medical Image Perception Society (Gale). Gale is also an Honorary Fellow of the Royal College of Radiology in recognition of achievements in understanding visual perception of breast scan images. The Unit includes membership of over 20 **Advisory and Consultancy Bodies** including: Bradford Animation Festival; Fashioning an Ethical Industry steering group; Social Sciences and Humanities Research Board, Canada; British National Committee of CIHA Comité International d'Histoire de l'Art; Nissan/Renault Technical Advisory Board; Adidas Research & Innovation Advisory Board; Association of Safe Patient Handling Professionals. Recognition of excellent individual academic contribution has generated: **Visiting Professorships** at University of Hasselt, Belgium (Morris); Vaal University of Technology, South Africa (Campbell); Art History and Visual Studies, University of Gothenburg, Sweden (Meskimmon); Research and Master Teaching Fellowship at VCA University of Melbourne (Whiteley); over 30 **invitations for Keynote Presentations** at institutions and conferences including: International Conference on Machine Design and Production (Cyprus, 2010); SMART-TBIS (Textile Bioengineering and Informatics Society, Hong Kong 2008); Humanities Research Centre, Australian National University, Canberra; Association of Art Historians (AAH 2009); 16th Annual China Sculpture Conference; InterNoise 2012 (Osaka, Japan); American College of Sports Medicine (Indianapolis, 2013); Oxyane symposium: Sciences pour L'industrie du sport (France, 2011). The contribution of a number of individuals in the Unit has been recognized through **Awards:** e.g. US Army Medical Association best paper award (Mansfield 2012); International Ergonomics Association/JOSE Best Paper (Havenith, 2009), Best Paper Award – Practice, German Ergonomics Society (Havenith, 2008); Animex Director's Award for services to the Festival and Achievement in Animation (Wells 2008); LGN Street Design Awards (Atkin 2009); Grafia: Golden Award for Book Design from Finnish Professional Graphic Designers (Nimkulrat 2010); Industrial Design Excellence Award (Evans 2011).

**Influence:** The Unit influences the development of specific disciplines within Art and Design (History, Practice and Theory) through innovation, peer review and examination. It exerts influence by members' involvement on editorial boards and its contribution to the direction of discourses by convening conferences, leading seminars and networks, introducing new academic journals. Unit staff are **Lead Editors** for 12 international journals including: *Animation Practice*, *Process & Production*; *Applied Ergonomics*; *Art and the Public Sphere Journal*; *Design and Technology Education*; *Ergonomics*; *The Poster: Visual Rhetoric in the Public Sphere*; *J. of Textile Design Research and Practice*; *TRACEY: Drawing and Visualisation*; Members are **Book Series Editors:**

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*Rethinking Art's Histories* (Manchester University Press); *RadicalAesthetics-RadicalArt* (Bloomsbury), and are **Editors** and/or sit on the **Editorial Boards** of 30 academic journals including: *J. of Design Research*, *Design Studies*, *Open Arts Journal*; *J. of Research Practice*; *Craft Research*; *European J. of Applied Physiology*; *Rapid Prototyping Journal*; *J. for Traffic Injury Prevention*; *3x3: the J. of Contemporary Illustration*. In addition to the international conferences hosted at Loughborough developing the fields of Drawing and Visualisation, Experiential Knowledge, Textiles and Materials Technology and Feminist Aesthetics, staff have contributed to their disciplines through the **Organisation/Curation** of a wide range of events e.g. *Ergonomics: Real Design* (The Design Museum, 2009); *Watch Me Move: the Animation Show*, (Barbican, 2011 and Taiwan, Brazil, Canada, USA). Further influence on the research base is evidenced by the Unit's involvement in **Peer Review of Research Funding**. 9 staff are members of the AHRC Peer Review College (Bhamra, Bibb, Bingham, Campbell, Edwards, Evans, Meskimmon, Porter, Wells) and 4 members of EPSRC Peer Review College (Bhamra, Bibb, Campbell, Gale). The Unit includes 15 Peer Reviewers of 9 UK funding bodies including: AHRC (3 staff); British Council; Dunhill Medical; EPSRC (10 staff); ESRC (4 staff); Technology Strategy Board (3 staff); National Institute for Health Research; Institute for Occupational Safety and Health; Health Service Research. It includes 8 Peer Reviewers of 14 different **international Funding Bodies** including: Austrian Science Fund; European Cooperation in Science and Technology Switzerland; Canadian Research Council; Danish Research Council; DRS Advanced Sustainable Lighting Solutions; Dutch Technology Foundation-Philips Research; Hong Kong Research Grant Council; Icelandic Research Fund; Italian Research and University Evaluation Agency; National Research Foundation South Africa; Norwegian Research Council; NSERC Canada; NWO Dutch Organization for Scientific Research; National Science Foundation USA; Vienna Science and Technology Fund WWTF. Unit members regularly **Referee** for a wide range of **Academic Journals** in all areas of Unit expertise. Invitations to referee or judge **conferences / competitions / festivals** have included: *EVA Conference Electronic Visualisation and the Arts* (London 2013); *Design and Emotion*, Institute of Design, Illinois; *Bradford Animation and Flip Animation Festivals*.

A measure of the scale and status of the contribution made by staff is the number of times they have acted as external examiners. The Unit has conducted over 50 **PhD examinations** in 29 UK Universities and a further 30 examinations internationally in Australia, Belgium, Canada, China, France, India, Italy, Netherlands, Norway, Singapore, South Africa, Sweden.

**Collaboration:** The Unit sustains strong research links with a wide range of collaborators from local to global, representing academic, government, industrial, charitable and public sector organisations. E.g. innovative therapeutic applications of the animation process (Hani) are being developed in collaboration with several agencies: Barnardos, Circles UK and the National Probation Service; collaboration with the NHS spans from ambulance design, through design of drug labelling and customisation of prosthetics, to systems analysis of errors and improvements in systems design and presentation of medical images. Individuals are engaged in advancing research agendas within their different **disciplinary networks** such as: Service Design Research UK Network with Lancaster University (Lo, Bhamra, Mitchell); global initiatives driven in association with ASIFA (Association Internationale du Film d'Animation), Society for Animation Studies, International Screenwriting Research Network and Animazing Spotlight (Pixar, UPA, American Cinemateque) (Wells); global expansion of the drawing research network exemplified by the 2013 DRN conference at Metropolitan Museum of Art/Columbia University, New York; launching the UK Chapter of the Design and Emotion Society. Collaborative work with National and **international Academic institutions** is extensive and varied, and includes: the development of critical seminar exchange programs with Finnish Academy of Fine Arts, Helsinki (Hallsten); editorship of a multi-volume Encyclopaedia of Design with associate editors in US and Australia and over 200 contributors globally (Edwards); developing sustainable creative practices with University of São Paulo (Harland), and with partners in Australia, Brazil, China and Germany (Whiteley). Much of the Unit's **extensive collaborative work with industry** is generated and sustained within Research Group activity, outlined in section b. In many cases industry organisations partner with Unit research to form part of research consortia. E.g. TSB-funded research with Nissan; EPSRC-funded research with E.ON; part-funding of studentships such as with Adidas, Bridgestone, Nissan, Ordnance Survey, Oxylane (Decathlon).