Institution:	**Goldsmiths, University of London**
Unit of Assessment:	**11 Computing**

a. Overview

Over a decade ago, the Goldsmiths Computing Department set out to redefine itself as an active centre of research and teaching devoted to aspects of computing associated with Goldsmiths' core strengths in arts theory and practice and in social and cultural theory. We have followed this route consistently throughout the last ten years, building momentum over this period, and forging a unique research vision of **computer science research** as an inter-disciplinary set of practices, methods and techniques clustered around the roles of computation in **individual creativity** and **social connectivity.**

Following this vision of research helps us renew and invigorate computer science as a discipline through a range of unusual forms of engagement and activity: artistic works, musical performances, social science studies alongside the more traditional peer-reviewed paper outputs. Following this vision also puts as at the heart of Goldsmiths' intellectual life. The department is home to two research centres that enthusiastically include colleagues from almost every department of the university; we are a natural partner in large multi-department research projects, frequently taking a leading and defining role in their inception and development; and we run multi-disciplinary taught postgraduate courses and PhD programmes with wide involvement across the range of Goldsmiths' academic environment.

The research environment described in this document is one that has been built consciously to support interdisciplinarity across the university, enabling us to work closely with Goldsmiths' strongest, most successful and most innovative departments. This environment has led to our being an international research leader in computing related to arts and social science and provides the base from which to strengthen that position in the future.

b. Research Strategy

In RAE2001 we announced our intention of concentrating future research on multi-disciplinary computer science informing and informed by arts and humanities, and in RAE2008 we reported the results of the first few years of that strategy. The 2008 RAE panel noted the benefits to our own research of this strategic concentration stating "*the strategic focus on the creative industries … contributed in very large part to a vital, sustainable and credible submission*" and noted too the benefits to the wider academic community reporting "*[the] inter-disciplinarity of the submission is strongly commended and contributes substantially to the diversity of UK research*." Over the present REF period, we have substantially strengthened this kind of research magnifying its benefits to us and to the wider subject, as evidenced by: funding from a broader spread of sources (including four different UK Research Councils), larger grants and rapidly expanding active research grants (15 million in this REF period, following 5 million in RAE2008 and 30 thousand in RAE2001), tripling the average annual research spend reported in RAE2008 (from £350K per year to over £1M per year reported here), attracting new arts-computing staff (including staff from established positions at Princeton, Imperial and Newcastle); a strong presence at international arts computing conferences and workshops, at times organising and hosting them; more publications in very high-quality computing journals; a dedicated bespoke new research infrastructure; substantially more PhD students (total completions quadrupled from RAE2008 to REF2014); new multi-disciplinary research centres in partnership with Goldsmiths leading research departments; more contract research and consultancy; new spin outs; and leadership roles on London-wide and national interdisciplinary research networks.

In parallel to our established Arts Computing development, we have started taking a much more vigorous role in research related to cultural theory and social sciences. This has always been part of our research but it is increasing in prominence and will be a principal area of growth in the next REF period. This is a natural extension of our target research area of Computer Science related to the Digital Creative Economy. Our position within the Creative Economy was instrumental in the recent award of a £12.7M EPSRC Centre for Doctoral Training in Intelligent Games & Game Intelligence. The Centre is an equal partnership with Goldsmiths, York and Essex with Goldsmiths taking the lead

in attracting and working with the sixty partner organisations (network organisations, games companies and user organisations) from the Creative Economy who wrote supporting letters. The CDT is an outcome of our growth and will be a stimulant to future growth, enabling us to spread our research vision through a generation of students educated in a major nationally significant post-graduate research centre.

The Research Strategy in Practice: Realising our vision demands vigorous engagement with a large range of subjects and practices, working in ways that mutually reinforce all contributing disciplines. For example, we have a broad strand of research exploring the relations between computation and creativity, informed by ideas, techniques and results from music and art theory and practice, psychology, philosophy, neuroscience, engineering, and computer science and which leads to results that span these subjects too: new art works (public installations in Trafalgar Square and Venice Bienalle winning installations), new forms of curation (including a major international triennial in China and innovations in online exhibitions), new kinds of musical performances (including audience-controlled generative music at the Royal Albert Hall and music controlled by new kinds of interfaces at the Barbican), books of philosophical essays, pure science (including brain studies reported by the US National Academy of Science), engineered artefacts (including new hardware interface devices for creative expression), and, of course, new computer science results that are reported in traditional computer science outputs.

As an example of how this comes together, Colton's work, currently funded by an EPSRC Leadership Fellowship, involves the sustained development of a software system, the Painting Fool, that has produced paintings that have been shown in several exhibitions. This research is reported extensively in the press (including the Guardian, New Scientist and BBC Horizon) and continues to generate numerous technical papers describing advances in AI. In addition, this work opens up new discourses about what making a computational system creative teaches us about the nature of both creativity and computation. As another example, we have a new BBSRC grant, jointly with Imperial College Bioinformatics, to produce a multimedia interactive platform, combining visualisations and multisensory (sight, sound, touch) interactions for exploring and explaining the docking of molecules onto a given target protein. The work builds on fundamental bio-chemistry and computer science research in graphics and haptics to produce new computer science techniques for visualisation and interaction, new bio-chemical understanding, new artworks, and new games. Projects like these enrich computer science through its leading role in broad academic inquiries into individual creativity and social communication.

Individual Creativity: We are devoted to studying the relations of people to computational systems and to providing systems that enhance people's lives and abilities. A major goal of this research is supporting people's ability to be creative. A first step is providing interactions that are more natural than computer keyboards and mice: enabling interaction through motion and gesture, sound, touch, and brainwaves. Tanaka, supported by an ERC fellowship, builds music interfaces that apply machine learning to interpreting gestures; several researchers, in collaboration with IRCAM, make interfaces that turn ordinary objects into musical instruments by their responses to touch (Financial Times, 20/09/2013). Grierson developed new brain machine interface devices and uses them in musical performances collaborating with Roll 7, an SME who has started the process of commercialising these devices. Fiebrink built a real-time machine learning system with the motivating application of learning about musicians' interactions. This leads to on-the-fly creation of musical instruments and also supports musical composition, performance and education. Ursu developed tools for creating interactive non-linear narratives of many forms, including video some of which have been shown on primetime national television. Gillies works with motion capture systems, studying how actors express emotions and using that information to make more realistic characters in video games. Colton and Gow developed systems, with Rebellion Games, that analyse play in their video games, which led to a new research project (the what if machine with collaborators including Cambridge) that looks at investigating computational approaches to fictional ideation. Pachet and d'Inverno have been developing systems with Sony Computer Science Labs in Paris to enable jazz musicians to extend their musical virtuosity. Leymarie and Latham have built evolutionary systems that create geometric structures as artworks; Leymarie and Tresset developed robots that draw portraits; the robots and portraits have been shown at several international arts exhibitions (and watched by 1.4 million on YouTube). Making systems like these leads to a deep

understanding of human interactions with computational systems. Journal papers, and a strong representation of outputs at leading conferences such CHI2013, show how effectively we are exploring this area. Moreover, we study computation and creativity from theoretical as well as practical viewpoints. We are interested not only in creative works and the processes that produced them, but also in exploring what it means to be creative. That full range is covered in the book, Computers and Creativity, co-edited by d'Inverno, containing half a dozen chapters from our academic staff.

Social Connectivity: We have an active and growing interest in how Computers are used in interaction among people. This is a series of radically interdisciplinary investigations, involving a number of other departments, including Sociology, Media, and Cultural Studies. Zimmer had a joint grant with Media, studying the use of metadata in social networking. Farrahi has been studying interactions, largely studying mobile phone data, to understand questions about politics and health. Ursu, in a strategic partnership with BT Research in Martlesham, has been developing (through a series of EU projects -- TA2, NM2, Vconnect)) software systems for intelligently enabling social interaction. The latest project involves connecting several rooms, each of which uses three cameras: the system automatically captures the dynamics of a natural conversation across the different rooms. Also, through a series of EU projects (ACE, PRAISE), d'Inverno is developing systems for connecting people and creating communities in arts-based environments: one project around experiencing museums (with the Horniman Museum in Lewisham) and another social music education. Barth explores societal implications of social networking technologies in collaboration with the Royal Society of Arts, and with commercial entities Rackspace, Edelman and 3Monkeys. Ohene-Djan has spent ten years working on video sharing as a vehicle for community creation. This work was spun out as a company called Winkball, which amassed three million video interviews and brought together about 150,000 users. Ohene-Djan collaborated with the charity Deafax to make a bespoke system for enabling interactions among the deaf community. Jefferies has been working with Concordia University in Canada on arts projects using wearable computation devices to communicate a sense of presence of people from other parts of the world. Greyworld (Shoben and Zimmer in this submission), in many projects, used technologies to change interactions with public spaces, including Trafalgar Square and Bradford bus stops.

Invigorating Computer Science: What we do breathes new life into computer science by broadening the range of things done by and with computers, by extending the spectrum of engagements that people have with computational systems and by bringing different kinds of thinking to more standardly recognisable computer science. As examples: thinking about music leads to new results in signal processing, making arts installations brings new ways of thinking about HCI, working with social scientists leads to new network and agent models. In these ways we contribute to CS as a discipline, disseminating this work through high-level CS outlets: this submission contains 11 *IEEE Transaction*, 5 *ACM Transaction*, 3 *Theoretical Computer Science*, 2 *Neurocomputing* papers and about 20 other papers in particularly high-ranking (SJR ranking > 1) CS journals (e.g. Artificial Intelligence, Pattern Recognition and Automated Reasoning). All staff not cross-referred (Bishop, Blackwell, Casey, Colton, Danicic, d'Inverno, Farrahi, Febrink, Gillies, Gow, Leymarie, Nikolaev, Pachet, Pu, Rhodes, and Ursu) have at least one paper in this category.

Comparison to what we promised in RAE2008. In the last RAE, we promised to continue invigorating computer science research by engagements with arts. We have focussed effort in achieving this. We also promised "*to get other disciplines to the same position [in our research] as Art and Design*", particularly targeting Music. Now, arguably, more of our work is aligned to music than to anything else with several large joint research projects centring on Music (Praise, OMRAS2, Transforming Musicology, Metagesture Music). Our engagement with Social Science departments has also strengthened enormously since 2008. We also promised "*to provide a research environment in which … researchers from many research cultures can interact …, sharing ideas informally and through seminars*." We have two centres for ensuring this: they are described below. The one quantifiable prediction we made was that we would "*increase our post-graduate student numbers to fifty in the next three years and … maintain (at least) our present high level of external funding* [5M total was reported in RAE 2008]". We have exceeded these targets, achieving double the post-graduate student target (we now have 103), and tripling the research funding gained (now, £15M), and the annual research spend (from £350K to over £1M).

How this research will develop in the future: We will continue to grow our research reach and significance by working strategically with other institutions and other Goldsmiths departments, particularly Arts, Music, Sociology and Media & Communication to explore individual creativity and social connectivity. Through our new CDT, we will work with York, Essex, and commercial entities in the creative sector to influence the future of technologies for creation and interaction. Our other targeted growth area is in social computing: exploring social life by gathering and analysing large quantities of social networking data; and improving social connectivity by building systems that empower communities and enable individual and social creativity. These are strategic goals for both the Department and the University; Goldsmiths is currently developing a tri-partite relationship with Cambridge and the LSE to forge a way of working together to explore society through social data. Computing (see below) has recently made key appointments in data-science and Sociology in data-informed social science to support this initiative.

We will substantially increase our significance on the development of computer science by developing larger numbers of post-doctoral fellows and PhDs. Our specific goals are to increase by 25% the grants won and by 100% the number of PhD completions. We will also increase our reach through enterprise activities especially in the creative and cultural sectors. The growing maturity and visibility of the department will enable us to robustly increase our growing impact on the academic community by bringing the kind of activities we undertake increasingly into the mainstream.

Research structures that come from and support the research: Each of our two strategic priorities is supported by a research centre: Individual Creativity is supported by Goldsmiths Digital Studios (GDS) and Social Connectivity by the newly-formed Centre for Creative and Social Technologies (CAST). The multi-disciplinarity of the research is reflected in the activities, governance and structures of these centres: both are housed in Computing and promote cross-university involvement in strategic development, research projects, supervision and public events. GDS is devoted to research and post-graduate teaching in digital technologies in artistic practice. It runs two seminars a week, one for post-graduates and one public facing. Both series involve staff and students from Music, Design, Visual Cultures and Fine Arts. It is also is the natural home of the music and arts based research within the department. CAST is devoted to developing new digital technologies for social research and, at the same time, researching the societal impact of technology. CAST runs seminar series (including an ESRC methods series), and supports joint post-graduate teaching with the Sociology and Media Departments at Goldsmiths (both near the very top of their disciplines in the RAE2008 results).

c. People

I. Staffing strategy related to research strategy and physical infrastructure. We are growing substantially from a stable base: Geraint Wiggins, who took up a chair at Queen Mary, is the only academic researcher to leave in the REF period, while we have made seven full time appointments (Barth, Colton, Fiebrink, Ferrahi, Gow, McQuillan and Tanaka) and three part-time ones (Abtan, Pachet, McLachlan). We choose new academic staff principally on their ability to carry forward our multi-disciplinary research goals. All three professors hired in this period span Computer Science and Arts: Tanaka (background in music; research involving performance and composition) joined us from Newcastle, where he was a professor and Director of Culture Lab; Colton (research in computational creativity; exhibited art in galleries) joined us from a Readership at Imperial; Pachet (Senior Researcher at Sony Labs) joined us part-time to work on projects across Computing and Music. With their arrival we now have six professors in the department who have a variant of the word “art”, “music” or “creativity” in their titles (Colton, Jefferies, Latham, Pachet, Prophet and Shoben). Others with a multi-disciplinary computer science background include McQuillan (Social Media), Barth (Sociology), Fiebrink (Music, who joined us recently from a tenure-track position at Princeton), and Farrahi (who collaborates with Sandy Pentland at MIT Media Lab to understand social life and who will play a key role in our new strategic collaboration with LSE and Cambridge). Our staffing strategy is to bring talented people together from different academic backgrounds and encourage them to work together. To increase intellectual cross-fertilisation, we have made two new joint appointments: Abtan (joint with Music, PhD from Brown University in Multimedia & Electronic Music Experiments) and McLachlan (joint with Media & Communications, background in digital

journalism). Our physical infrastructure (detailed below) is designed to reinforce an influx of other areas of Goldsmiths research and practice into computing through our open-plan spaces for collaboration that welcome staff and students from across college. The whole effect is that of a continuous space that reflects the continuum of research interests.

Career development support. New appointments are assigned established senior staff members with related research as mentors, quickly incorporating the new staff into the department's research culture. For many staff members, mentoring includes collectively developing group shows and performances. New members of staff are always given light workloads and are strongly encouraged to participate in Goldsmiths' Postgraduate Certificate in the Management of Teaching and Learning. We are fully committed to the Concordat to Support the Career Development of Researchers and our policy is that senior staff directing projects write international peer-reviewed journal articles, many of which are being submitted for the REF, collaboratively with research assistants. RAs are always named as co-authors, often as lead author, and the democratic and fluid nature of our research environment ensures that confidence and capacity to build a publication record are developed. We often host workshops and expos that include a very mixed population of staff, ECRs and students. Our university-wide supportive environment and infrastructure led to Goldsmiths winning a badge of excellence for supporting ECRs in 2012. In addition, this support helped two members of staff (Gillies and Grierson) move from being new researchers in RAE2008 to senior lecturers now. Other promotions in the period include: Bishop to professor; Ursu to reader and then professor at two institutions (each half-time: York and Goldsmiths), and Crawford (included in the Goldsmiths music submission) to professor. Jefferies has been appointed to the newly created position of *Associate Pro-Warden* with responsibility for developing strategies to enhance Goldsmiths' interfaces with the creative industries nationally and internationally. Earlier this year, d'Inverno was appointed Pro-Warden (PVC) with strategic responsibility for the university's research and enterprise. These last two appointments underline the centrality of Computing in Goldsmiths' research culture and also the university-wide mission to work with London and International Creative and Cultural Industries, a key facet of the Department Research and Impact Strategies.

The department is supportive of the family and personal obligations of all members of staff, such as parents of young children. We allow people with caring responsibilities flexible working conditions, protecting them from teaching and other duties that require University attendance in especially pressured times. This is partly enabled by a culture that supports and encourages staff members to share work collaboratively with colleagues. Staff members are also encouraged, partially through a system of one-to-one Professional Development Reviews, usually with the HoD, to reflect on their careers, working towards individual and group goals. These sessions are available to both permanent and fixed-term research staff. The HoD liaises on research matters with the head of Research, who chairs the Research Committee, which organises seminars, away-days, strategy discussions, and regular seminar series in which every post-doctoral research staff member and PhD student is encouraged to present work several times a year. That committee also allocates seed-corn grants, particularly to help ECRs with travel for collaboration and conference participation. Members of the department frequently collaborate with each other on research bids and on research papers. Teams, typically made up of researchers at every stage of their careers, interact energetically throughout the processes of planning, applying for, and undertaking projects. The department has run several workshops in which members of the department read and critique each other's research bids and papers before submitting them, allowing researchers to learn about each other's research. For example, we had several of these meetings leading up to the CHI 2013 deadline, resulting in six Goldsmiths papers at that conference. This way of mentoring in research staff is deeply ingrained in the department and was used as an example of best practice when Zimmer, working with the then Dean of the Graduate School, set up a university-wide early career researcher mentoring scheme, called GRIT (Goldsmiths Research Initiation Training).

Diversity and Equality: We are absolutely committed to increasing the role of women in Computer Science. In the last two years, five of the seven new appointments to computing posts were made to women (Fiebank, Abtan, Farrahi, Barth, McLachlan); we run outreach seminars and hands-on workshops with female sixth-formers and pre-GCSE girls, encouraging them to consider careers in Computing; we run seminars for women undergraduates to support them in a still largely male-dominant academic computing world. Kate Devlin, a lecturer, who has taken Goldsmiths-supported

media training to become a spokesperson for women in computing, speaks on these issues in important media outlets, including the BBC. Rose Hepworth, an administrator and researcher in the department, received an internal Goldsmiths grant to run a project for attracting more women to our courses and to support them while they are here. She and Devlin run a blog promoting women in CS. Some of our postgraduate courses have more women than men and 25% of the students on our undergraduate course in creative computing are female. We are also committed to broadening access to Computing in other ways. Earlier this year, we ran a Coursera course in Creative Programming that allowed us to disseminate broadly our view of computer science. The survey statistics indicate that 30% of the 100,000 students who followed the course were women. In addition, our students are extremely diverse ethnically and socially; we are increasingly developing some of these students through our own and other post-graduate programmes. The department has always taken a lead on WP activities. For example, we were the first department to introduce progression agreements for local FE colleges. In recognition of this leadership, Ohene-Djan was appointed in 2013 as associate pro-warden responsible for Goldsmiths' strategies for enabling WP.

Staff with personal research fellowships. We have two professors on personal fellowships: Tanaka is on a European Research Council (ERC) starting grant, and Colton is an EPSRC Leadership Fellow. We support these grant-holders by giving them the space and administrative support they need for their work, while not expecting any formal teaching or administration from them. Their only roles are strategic ones: leading on research strategy and infrastructure and acting as mentors for our ECRs especially. Members of staff are always encouraged to apply for these fellowships (in the next period we expect to see significant growth) just as we encourage new academic staff to apply for EPSRC and ERC Starting Grants (e.g. Gillies EP/H02977X/1).

II. Research Students and our strategy: PhD students are an integral part of our research strategy, playing an active part in all research activities from grant preparation to paper writing to running, and presenting at, department seminars. For example, we have an established evening seminar series, called the Thursday Club. This is an important weekly venue well-known in the London Computational Arts community for arts and technology presentations demos, and events that typically attracts over fifty attendees. PhD students do most of the organisation of the series and some of the presentations. We run two doctoral research programmes: *Arts and Computing Technology (ACT)* and *Computer Science* each led by a set of senior staff who coordinate collaborative activities within a cohort. Students on ACT, one of the few practice-based PhDs in the University of London, produce both Art and Technology and reflect on the relations between the two. This PhD programme is a clear reflection of our research philosophy and practice. Starting next year we plan to run a third programme on *Social Technologies*: this will be parallel to ACT and will support our present disciplinary expansion. All students on all programmes have 2 supervisors, often with one from a department outside Computing. In Social Technologies it will be compulsory to have a supervisor in Computing and a supervisor in a Social Science department.

Training and supporting PhDs: Our investment in training and supporting PhDs can be seen in the large percentage growth in PhD completions in the REF period. This investment and our improving track-record has been recognised through our winning of a CDT that will greatly increase our opportunities for supporting PhD students. The CDT will offer students a combination of the best training experiences in Goldsmiths, Essex, and York. We will also collaborate strongly with the six partner institutions on the newly awarded £17M AHRC BGP2 Consortium for Humanities and the Arts South-East England (CHASE) Doctoral Training Centre. New students will join current students in playing an active part in the department and university research communities. The department will adapt its practice to accommodate the new students, expanding weekly seminars, support for travel, developing teaching practice, pastoral care and introducing more bursary schemes for studentships in strategic areas of growth.

d. Income, infrastructure and facilities

Provision and operation of specialist infrastructure and facilities. Overheads from successful research grants coupled with strategic investment in Computing from the university have enabled us to improve radically the research infrastructure we described in RAE2008. We have several new

studio/labs with specialist equipment that supports our research. We have labs for sound and visual work; spaces for people to collaborate on composing and performing music; exhibition spaces to show computing artworks, including the newly renovated St James's Church with bespoke performance and exhibition spaces; facilities for designing and building artefacts; labs for physical interactions with computational systems; rooms set up for researching seamless remote tele-communications, and several open-plan offices for post-docs and PhD students who work on a broad spectrum of arts and social science-based computing, often surrounded by relevant staff offices. All of this is designed to support the staffing strategy outlined above.

Specifically we have built an interaction lab, a physical computing lab, a games lab, DIY lab, and a set of three connected video interaction suites since 2008. The interaction lab consists of: a professional recording studio, ambisonic audio array, motion capture system, VR headsets, and soundproofed control room that also serves as an independent experimental space. The physical computing lab and DIY lab contain workbenches and project space for designing electronics circuits to be embedded in physical objects. The games lab contains specialised high-spec games PCs and development versions of new technologies (including forthcoming Playstations). The video interaction suites are virtually connected sitting rooms, each with a suite of television cameras, intelligently controlled to make remote meetings feel natural. In addition, we have 3D printer, large format professional plotter/printer, and a server cluster for dealing with large data.

Research funding portfolio: The value of all the department grants whose dates intersect the REF period is over £15M . The range of funding sources reflects our breadth with funding from four different UK research councils: the AHRC, BBSRC, EPSRC, and ESRC. In addition we have support from the British Academy, Cyprus Research Agency, DTI, ERC, EU, Leverhulme, Mellon and Templeton. We are part of many consortium grants, several of which we lead. For example, we lead on the VConnect EU grant, which is a €5.5 million grant with 8 other partners, including BT, Alcatel and Fraunhofer; and we lead the £2M AHRC grant Transforming Musicology with partners Oxford, Queen Mary and Lancaster. We also receive commissions and funding for artworks in ways that do not appear as research funding on REF4.

Enterprise—Consultancies, Contract Research, and Spin-outs: The Goldsmiths Enterprise Office chose Computing to pilot a new strategy for working in close collaboration with academic departments. This has led to new ways of growing strategic non-academic partnerships, capitalising on IP, and increasing our influence through public engagement, performances, exhibitions, contract research and consultancy. We have recently run three significant consultancy projects: one for Intel and two for Rackspace and are presently working to release a commercial product based on our brain-interface work and with others to follow (Multimedia ICS).

e. Collaboration and contribution to the discipline or research base

Our research culture provides unusual opportunities for injecting Computer Science research with ideas, techniques and methods from a range of other intellectual traditions. It also enables us to transfer computing ideas and rigour into other domains, broadening the research base across a large spectrum of disciplines. Our research is highly collaborative, frequently involving partner disciplines that are more public-facing than computer science tends to be, giving us an opportunity to strengthen the discipline of Computer Science through engagement with a wide audience.

Support for research collaborations: The department thrives on research collaboration. About 80% of the projects listed in REF4 are collaborative. On-going strategic collaborations, spanning several projects each, include Queen Mary, Cambridge, Lancaster, AAAI, Dartmouth, MIT, Sony Computer Science Lab, BT, the BBC, IRCAM, and a number of design and technology SMEs in London. These collaborations are supported by diverse internal and external mechanisms. One important external funding source for our collaborations is EU Framework grants: for example, a collaboration with BT and various European institutions has been sustained for over a decade by a string of FP6 and FP7 grants. National research councils have supported a number of projects jointly with other UK universities and we collaborate with companies through KTPs, through consultancy and through direct commercially funded contract research with large companies and UK (mostly London) and US-based start-ups. These external collaborations are all supported at a university

level by the Goldsmiths Research and Enterprise team, who work pro-actively with department researchers and with research councils, the EU, and companies to develop projects. As a department, we have run several informal workshops with BT, two workshops with the BBC, and workshops with other potential commercial partners as ways of generating more research.

Support for interdisciplinary research: Most of this document enumerates department support for interdisciplinary research across the university, running projects, seminars, expos (often reported by the BBC) and round tables with other departments. The department hosts a number of high-profile Arts Computing research visitors including Turner Prize-nominated artists (Langlands & Bell), a National Theatre director (Melly Still), and a prominent UK composer (Adrian Sutton). These visitors help us understand professional practice and help us bring those ideas to computing as well as bringing computing ideas to these practices. In addition, we have appointed Sebastian Anhert (co-leader of the Cambridge Networks Network, a group exploring the modelling techniques we plan to use in data social science) as a Visiting Researcher to help us develop the strategic Goldsmiths/LSE/Cambridge initiative described above. We run national initiatives too: for example, an ESRC network with Goldsmiths Sociology (and Manchester and Cardiff) specifically set-up to cross-fertilise computing technology and thinking and social science practice and ideas.

How collaboration with users informs research: Working with users is a natural part of our research and impact strategies (see REF 3A). Much of our work is widely disseminated and the anticipation of that dissemination is fundamental to the thinking in the research. For example, we have performed music-based research in numerous venues including the Barbican Centre and the Royal Albert Hall. The RAH concert engaged the audience as active parts of a real-time composition: preparation involved working with users at every stage. As another example, designing the Wekinator software involved working closely with composers and performers throughout the design. We work with many game companies such as Sony and Lionhead Studios and will continue to do so in the IGGI CDT. We work with disabled groups including deaf groups (ICS Winkball) and severely disabled schoolchildren (see ICS Multimedia). In another example, the EU project PRAISE develops software systems by iteratively testing rapidly prototyped versions with students at Bristol Pre-Conservatoire, Leeds College of Music, and Goldsmiths Music.

Contribution to the Academic and Broader Communities: In 2014, we will host, and Bishop will chair, the 50th anniversary AISB convention. The convention will consist of 27 symposia (many organised by members of the department). This is an extension of Bishop's role as coordinator of the Whitehead Lecture Series (lectures about Computing and Psychology) for almost a decade. Goldsmiths Computing co-founded the ongoing conference/workshop series on Computational Creativity; we will chair the meeting in 2014 when we will also be hosting the New Interfaces for Music Expression (NIME) conference. We curate large international shows like the Hangzhou triennial in China and ISEA in Turkey. We organise and run a host of public workshops and seminars and contribute our research and enterprise expertise to the wider community through work with charities: staff are on several charity boards, including Bethnal Green Ventures. We play a significant part in the regeneration of SE London by opening our own doors to a range of events and activities and by performing at a range of local venues in Lewisham. The department takes a strategic lead on several London and UK inter-disciplinary networks many specifically looking at creativity and the creative industries including Creativeworks (an AHRC funded London Knowledge transfer initiative fusing academic research and the creative Industries, d'Inverno), CREATE (large AHRC funded project researching new business models in the digital economy, Jefferies), Prosecco (EU-funded promoting the scientific exploration of computational creativity, Colton) and recently, for example, Mist and Real Time Methods (AHRC and ERC, Zimmer), and Dracp (AHRC BT Research Network).

Our prominence and leadership in the broader community is a testament to how far we have come in conceiving, implementing and publicising our distinctive view of computing. We built a rapidly-improving research culture, with research income up by a factor of 500 in two ref periods, with invitations to present at high-profile venues like BBC Radio 4, the V&A and the Barbican, with prestigious collaborators from many intellectual traditions. This defines a particular kind of computer science, one with many forms of outputs from high-ranking computer science journal articles to software for creative practitioners to generative music performances to a 2.5 tonne simulated sun in Trafalgar Square. This is Goldsmiths' Computer Science.