Institution:	**GOLDSMITHS, UNIVERSITY OF LONDON**
Unit of Assessment:	**11 Computing**
a. Context	

In REF5, we described a research culture developed deliberately to help Goldsmiths Computing realise its goal of leading multi-disciplinary research on understanding and enhancing individual creativity and social connectivity. Creating impact is crucial to that culture: we work with artists, designers, musicians, learners, technology companies, museums, education institutions and schools for children with disabilities; working together at every stage to ensure that our research is valuable to everybody involved. We have all the forms of impact you would expect from a successful computer science department — software used in a range of applications; economic benefits to large and small companies; systems that lead to increased well-being — and on top of this we have special routes to impact — arts installations, performances, curation, social scientific investigations — that are particular to our distinctive research culture, which is characterised by:

1. Being a department of hybrid computer scientists who are also musicians, artists, composers, social scientists, curators, performers, activists, and charity volunteers. Our research is impactful both by our nature as a department in Goldsmiths and by our nature as individuals.
2. Being integrated within the cultural and creative life of London. We perform music in the Barbican and the Royal Albert Hall, mount arts exhibitions at the V&A and the South Bank, give workshops at the British Museum and Science Museum, work on the Tate website and produce artworks for high-profile public London spaces including Hampton Court and Trafalgar Square. We also perform and exhibit locally, bringing computational ideas and systems to large and small communities through artistic engagements.
3. We connect to large numbers of people through social and broadcast media. Two of our Youtube videos have over 2.2 million views between them, we made a film with 60 million international television views as part of an aids charity broadcast, we get substantial coverage in national and international print media, on radio (including a full half-hour of Radio 4), and appear regularly on television (including four appearances on BBC Newsnight for example).

Because of all these engagements with large audiences, our research has extraordinary reach for a computer science department. In the rest of this section, we will detail a few of the ways that these engagements also are significant.

Our work leads to: ***New forms of creativity***: We develop tools and methods ***with, for***, and ***as*** creative practitioners, forging innovative forms of technologically-enabled creativity. This expands the possibilities open to artists and changes the way that audiences think about both art and computation. ***New access to Creative Work***: We pioneer new ways of curating digital and physical arts exhibitions. We develop multimedia content analysis algorithms and use them to make open-access and bespoke company toolsets adding value to multimedia archives for many organisations including Yahoo! and Tate Galleries. We and others also use these tools in musical performances. ***Innovative games design***: We work with companies to expand what is possible in games. In two DTI-funded projects with Rebellion Games, we built real-time background creation tools, and researched how users interact with games. ***Improving Museum Experiences***: We work with museums to provide technologies that will make culture more accessible. Recent work includes: a system at the Horniman for museum goers to interact with each other around content, workshops at the British Museum; the Daphne Oram exhibition at the Science Museum. Two projects have added value to Tate websites: through tagging and reconfiguring video and reconfiguring the artworks, the latter winning the *Leonardo New Horizons Award* for Innovation in New Media. ***Empowering people with disabilities***: We collaborate with disabled users, charities and schools to help improve the lives of people with disabilities. For example, one project involves two charities, five secondary schools and a large number of hearing--impaired users, working with us to develop video-based systems that give deaf users richer educational experiences, better access to information, and more effective ways of communicating over the internet. ***Regeneration of Urban Spaces***: In an Arts Council England supported work, we set up the Mediashed as a way of regenerating Southend-on-Sea. A recent article, surveying urban regeneration work by Norman Foster, Frank Gehry and Greyworld (Shoben and Zimmer) stated: “public art has … help[ed] solve a series of urban issues” Similarly, Newsweek: “[Greyworld is] using its imaginative installations to transform the world’s dreary urban

areas." This refers to work in Bradford, Dublin, Warsaw, London and a Channel 4 commissioned set of installations in Burnley. ***Technology-based marketing***: Because some of our individual creativity is technological and visually arresting, organisations like Nokia use us to open up new possibilities for them and for their customers: Nokia showed some of our work with the tag-line "it's not the technology, it's what you do with it". And organisations have used some of our Social Connectivity work in communicating with particular groups, for example many have used our video communication tools to reach out to the deaf community. Department researchers have won 6 national marketing awards. **Public Understanding** Working with social scientists gives us new ways of understanding technology and of affecting public thinking on the social issues that technology raises. A project demonstrating Social Media threats to privacy was covered by 350 newspapers and led to a ten-minute segment on *Newsnight*.

b. Approach to impact

Our research involves intertwining different intellectual traditions and different interests. Our projects involve collaborating, at every stage, with beneficiaries: artists, games companies, media archive holders, children with disabilities, concert halls, galleries and community groups. Frequently, our researchers are, themselves, among the artists or musicians or social scientists, who will benefit the research. Our approach to impact is a close approach. Our impact results from co-developing new models and methods, co-creating new software and hardware, performing in large and small venues, creating public arts installations and working with community groups.

Financial support for this work comes from standard sources such as EU projects with collaborative components, RCUK funded research with partner organisations, consultancy for organisations, Knowledge Transfer Fellowships and Knowledge Transfer Partnerships. It also comes from less usual sources such as Arts commissions from public institutions, Arts Council England and the Chinese Government, fees from musical promoters, concert halls and galleries, and commissions from the BBC. Frequently, a project will benefit from different kinds of support as it develops. For example, Grierson joined Goldsmiths as an arts practitioner (supported by an AHRC Creative and Performing Arts Fellowship for artists working in academia), stayed on as an academic and secured an AHRC Knowledge Transfer Fellowship, which laid the foundations for a KTP with Roll7, a London-based games company, who are now developing the results commercially. This research is about interaction with musical systems, including direct brain-wave interpretation as reported by the BBC and The Guardian and used by Grierson and d'Inverno in musical performances at the Barbican. As another example, Leymarie and Latham, supported by the Scottish Government, through ITI Techmedia reused, *Mutator*, a system originally designed to generate artworks (some now in the permanent V&A collection) to make on-the-fly backgrounds for computer games. The work was later taken up as part of a TSB project with Rebellion Games.

How the department rewards researchers who have impact. Impact is incentivised as department research: we provide flexible working arrangements; travel money; administrative support; and space, including access to public-facing exhibition spaces on campus in a reclaimed and renovated church and off-campus in the Centre for Creative Collaboration near Kings Cross. As these exhibitions and performances are crucial to our research and impact, we underwrite performance activities in those spaces and elsewhere, including rehearsals and public showings for musical events, art exhibitions, and the annual Computing Expo, a public showcase for staff and student research. The research committee funds staff to work on impactful projects. Goldsmiths' new consultancy policy is to pass 90% of university revenue gained from consultancy on to the department; we, as a department, work with staff members to decide on the best way to use that money to reward the researcher and encourage future research and enterprise. Enterprise activities are an important part of factor in promotion decisions.

How we use university resources: Goldsmiths' Enterprise Office supports activities that drive research through to impact: for example, they provide us with legal and advisory services on IP, consultancy and commercialisation. Earlier this year, they hosted a conference/showcase, for nearly 200 companies, community groups, charities and funding agencies, at which we, and other departments, highlight impactful work. The university supports impact through public installations, exhibitions, performances, social media, the university website, the university magazine, internal emails and by working proactively with the public media as well as providing relevant staff

development workshops such as media training and public engagement. Partially in recognition of our commitment to impact, the university appointed two members of the department to leadership roles: d'Inverno is Goldsmiths' Pro-Warden (Research and Enterprise) and was particularly appointed to increase impact of university research; Jefferies is Goldsmiths' Associate Pro-Warden (Creative and Culture Industries) and is dedicated to increasing our external collaborations.

How we use broader resources We are supported by, and support, networks of universities, creative industries and cultural institutions including Creativeworks (AHRC funded; London-wide; set-up to bring universities and cultural institutions together) and Create (RCUK centre for copyright and new business models). Researchers in the department belong to a large number of artist and musical performance collectives across London and we are an intrinsic part of the strong community of creative practice in Lewisham, which provides many performance and exhibition spaces for contemporary computational arts.

c. Strategy and plans

Our research strategy, as outlined in REF5, leads directly to our impact strategy: to develop new technologies, new uses of technologies, and new computational models to broaden and deepen the beneficial impacts of arts and social science to well-being through enhanced individual creativity and social connectivity.

One tactic for achieving our strategic goals is to work through a system of partnerships: ongoing, long-term relationships within the creative industries. Sixty games and digital entertainment companies sent letters of support for our new Centre for Doctoral Training as recognition of our potential to enhance their part of the economy. Media companies, design houses and the games industry contribute to our research and teaching, influencing curriculum, providing internships, and research collaborations. In future, we will broaden our networks to include more partners in data science and social media. Farrahi, is in collaboration with MIT and an MIT Spin-out, Ginger, analysing phone data to infer health information. This is a model of the new kind of impactful project we will be developing in the next REF period. We also plan to increase: our non-academic influence through public engagement, contract research and consultancy and short CPD courses. Creating impact is what makes our research work: we benefit from our hybridity, frequently working as researcher and user; we benefit from our position in London, having access to cultural venues and the creative economy; we benefit from the large audiences our work attracts.

d. Relationship to case studies

The case studies were chosen to demonstrate a range of impact but they all show us working strategically with users throughout. They have all in their ways helped to define our impact culture.

1. The *Multimedia* study concerns enabling creativity. The study describes a long-term research history for the department that has formed the pattern for much of the way we operate. It starts from new algorithms and leads to a broad range of impacts: from making large multi-media collections a resource for creative work, to adding new forms of music to commercial games to empowering specific user groups. The highlighted researchers are practicing musicians who use this research in their compositions and their performances. The research involves working closely with two user groups, both with disabilities, enabling them to have impact themselves. Through this research, one of these groups, The Dean Rodney Singers, was given the opportunity to express its creativity through an exhibition in London's Royal Festival Hall and through mobile Apps and CDs.

2. In the *SpendInsight* study, we worked with an SME to develop tools for analysing expenditure and analysing organisations' carbon footprint. This is leading to more effective organisations, particularly public institutions. This study provides an example to us of how to work with a commercial company in a KTP and how to create impact from abstract research on artificial intelligence and software engineering.

3. The *Connecting People through Video* study, part of our growing interest in exploring and enhancing social connectivity, concerns systems for sharing videos. The study provides insight to us on how to spin-out research commercially. We worked closely with charities, schools, the police force, and the deaf community to make systems that lead to better connectivity for different groups, including the deaf community, and middle-eastern school children as part of a United Nations Relief and Works Agency supported project.