ERC Consolidator Grant 2020
Research proposal [Part B1]
(Part B1 is evaluated both in Step 1 and Step 2,
Part B2 is evaluated in Step 2 only)

Digital Scores – investigating the technological transformation of the music score

DigiScore

Cover Page:
- Name of the Principal Investigator (PI) – **Professor Dr. Craig Vear**
- Name of the PI's host institution for the project – **De Montfort University, Leicester, UK**
- Proposal duration in months – **60 months**

Digital scores utilising computational technology and digital media are emerging worldwide as the next evolutionary stage in the concept of the music score (Vear 2019). Yet there has been no scientific study of digital scores; nor their effect upon creativity and musicianship. This is remarkable for two reasons:

First, because digital scores are generating new music experiences, innovative compositional approaches, novel performance opportunities, and broader accessibility for a vast number of musicians and music cultures around the world.

Second, because many topics immediately adjacent or informing digital scores have been theorised thereby liberating these subjects and innovating creative practices, e.g. digital media art, digital performance, electro-acoustic music.

This project will launch the first scientific investigation into the transformation of the music score through computational technologies.

The core aims of the project are to:

(1) determine scientific knowledge of how digital scores stimulate new creative opportunities and experiences within a range of music practices,

(2) develop a theoretical framework for digital scores as an important transdisciplinary area of research,

(3) build a scientific study of inclusive digital musicianship through the transformative potential of the digital score.

This project will investigate these questions through an innovative combination of artistic and scientific research methods, undertaken by a transdisciplinary and international team of scientists and artists, led by a world expert of digital scores: Prof. Dr. Craig Vear. This is real "frontier research", the benefits of which extend beyond music studies into computer science, new media research, digital humanities, performance studies and creative practice.

Explain and justify the cross-panel or cross domain nature of your proposal, if a secondary panel is indicated in the online proposal submission forms. There is a limit of 1000 characters, spaces and line breaks included.

Section a: Extended Synopsis of the scientific proposal

The "Digital Scores" project comprises an ambitious programme of practice-based research interwoven with an innovative theoretical investigation into the transformation of the music score through new computational technologies. "Digital Scores" is the first large-scale, integrated project to address these challenges. The high-level objectives of this research project are to:

1) determine how new computational technologies, integrated as innovative music score systems, can lead to the communication of innovative music ideas, new music experiences, novel compositional approaches, new performance opportunities and music-making engagements, and broader accessibility for musicians of traditional and non-traditional backgrounds.
2) develop a transdisciplinary theoretical framework that situates digital scores within the wider fields of human-computer interaction, digital humanities and media studies, in order to understand the deep creative experiences of musicking (the act of music-making (Small 1989)) with digital scores built around *artificial intelligence, machine learning, internet networking, robotics, virtual and augmented reality, gaming* and *physical computing*.
3) discover how digital scores stimulate new relationships between musicians and how these profoundly influence the nature of the digital musician.

In most music cultures around the world there is a score system of some sort that operates as a communication interface between musicians (Apel 1961, Bagley 2004, Elsley 2002). For example, Western common-notation, guitar tablature, experimental graphic scores, Japanese shakuhachi music, Znamenny chants from Russia, and *Ome Swarlipi* for classical Indian music. Scores have been around since about 1400 BC (West 1994) and have been of great benefit to the practitioners that adopt them (ibid.). Over the course of hundreds of years and as music cultures embraced different code-systems and technologies, musicians utilised the communication potential of scores and notation (Maconie 1990). Creative invention within most of these music cultures has become intrinsically linked with its score system e.g. aleatoric music or structured improvisation in Western art music (Gnanadesikan 2009). These commonly accepted notation/score systems are efficient, globally recognised way of distributing ideas in music within certain contexts and for certain types of musicians. A variety of professional and project technologies are being developed to aid the digitisation of these page-based score systems such as *Sibelius* or *Finale* for Western common-notation, *GuitarPro* for tablature, and *Shakuhachi* for Japanese flute. In all cases, musical ideas are communicated from one mind to another, and the processes of score-making are embedded, infused, infected with the feel and shapes of these ideas to such an extent that they are capable of being re-communicated and enacted again and again through different musicians without the need for the primary composer to be present.

However, there are four principal limitations to these paper-based traditional music scores (including the digitised platforms): **first**, if a musician does not normally work with paper-based notation during performance because they are, say, techno/ dance music creators; indigenous musicians from the Asian tradition; improvising musicians, visually impaired, or untrained in any conservatoire discipline, then they are excluded from a significant range of score-based music-making activities and unsupported in sharing and distributing their own creative ideas. **Second**, if a compositional idea is not about a sequence of sonic events, then common-notation and traditional scores become limiting. Or, if the music idea is of such temporal complexity that it cannot be communicated using blunt symbols, vaguely anchored onto a piece of paper then a real-time computer-based system will be required. **Third**, the context for digital scores is rapidly emerging and this is a global concern. Writing in 2018, Hugill signalled the need to completely rethink our definition of musicians that work with, or are 'profoundly influenced by, digital technologies' (Hugill 2018). These 'digital musicians' are a 'new kind of musician: one who originates *and* performs, who creates *and* produces, and who harness the potential of technology in new and exciting ways' (ibid.). Furthermore, we are in an 'age of access' where the 'cultural diversity and integration' of the world's musics are leading to a 'world of stylistic plurality and blending' (Chapman 2012). This is due to rapid and open international communications; access to broad alternative musical cultures and ideas; and an acceptance that different kinds of music are of equal merit (ibid.). **Fourth**, computation is a platform that supports the contemporary musician's curiosity towards experimentation and the adaptation of contemporary technologies and cultures in their music-making.

Digital scores are a direct response to such limitations and desires for exploration, and enable new forms of creativity and expression with the potential for this to transform music for a great number of people from traditional and non-traditional backgrounds. Digital scores are emerging as an open-space for the plurality and blending of a diverse range of socio-cultural influences. They are a product of the digital musicians who wish to speak to other musicians through their digitized culture and mindset, regardless of "traditional" training and limiting/ fixed language systems (Bhagwati 2019, Magnusson 2019). Digital scores enable ideas to be contained and packaged in a combination of hardware and software and re-presented for live realization in performance. A defining feature is they benefit from the usability and functionality of dynamic technological

environments at some level, and are responsive, evolving as the performance progresses and operating on a level of interactivity more in common with gaming and immersive new-media art. Crucially, their language of notation is not bound up with traditional training, making them an ideal platform for inclusive music-making.

A digital score is not a singular, identifiable creation, nor is there an exemplar for what one might be. Nor are they dominated by the single sense of sight (symbols on a page). In fact, computation and digital media facilitate the communication of ideas across a range of senses. These could be embedded as visual, acoustic, tactile, robotic, or sonic and involve an equally wide range of materials such as text, movement, sound, code, image, haptic objects, as well as the sense of time, presence, and co-operation. They communicate contemporary ideas between musicians that would be difficult (if not impossible) to achieve using existing score-systems. Digital scores are as much about the creative potential of the medium as the technological solution and what these combined can deliver in no other way. Therefore, when a musician is interested in something that the technology is capable of creating through and with the technology - without which it couldn't have happened - then we can call that a digital score (e.g. using *Sibelius*' in-built tools and functions to create scores beyond that which is possible with pencil and paper). Digital scores can facilitate pre-defined journeys of sound across time and space that can be structured in advance or actively in performance, and support interactivity and live responses to such an extent that the composer, or the machine can be felt to be present in the performance as a co-operative entity. Digital scores can enhance the connections between musicians of all backgrounds and abilities by constructing relationships through interfaces, control parameters, interpretive data, sequencing and decision-making processes across the technology of the score. They can prioritise the creativity of the performer by placing them at the centre of the decision-making process in performance regardless of formal training.

What is emerging is a global body of practice that explores the potential of digital technology as a creative space for score-making. On the one hand there is a broad wealth of innovation offered to musicians through digital scores as they explore the same technology: for example, animated graphic scores and projected images, to mixed-media environments; from co-located telematics with distributed code to artificial intelligence, gaming, virtual reality, thinking machines, robotics and hacked-bodies. On the other-hand, they reflect the cultural interests of the community, making digital scores created by a Korean artist aesthetically and conceptually different from those created in, say, New York. Above all, digital scores not only go beyond traditional practice but also become part of future practice (Magnusson 2019).

A key aspect of the research context for the digital score is that it is mostly driven by creative practice. This is partly because of the pace of technological change, partly because the form itself attracts creative researchers who can see therein considerable experimental possibilities, and partly because of a relative lack of theoretical attention to the field (Hope 2017). The corpus of digital scores is still very much in formation, and as a creative phenomenon has only really been adopted in the past decade (discussed extensively in Vear 2019). In this period, however, it is clear that digital technology is transforming musicians' experience, creativity and professional practices of the score. Crucially, digital technology changes the nature of relationships in the concept of a score. The primary reason for this is that the digital technology operates as more than simply a tool in the creative process. Digital scores can be an active participant in the creation of the musical work as it offers a conversation with the musician. In doing so, it can define, arrange, outline, express, coordinate, collaborate and circumscribe ideas. But it can limit, confine, reduce, restrict and deform musical ideas too. This conversation is a core part of the creative process as the technology reaches into the creative ideas and edits, orders, proposes possibilities and limitations about what can and can't be represented in a specific format, technology or within an individual medium (Vear 2019). These in turn stimulate new relationships between musicians and opens up the possibilities of new creative experiences, and are transforming A) innovation (e.g. animated scoring systems); B) composition methods (e.g. working with artificial intelligence); C) performance environments (e.g. integrated cross-disciplinary performance); D) music-making engagement (e.g. telematics performance linked through distributed scores); and E) accessibility (e.g. communicating ideas between untrained, improvising, and indigenous musicians).

All the factors discussed above are transforming the digital score into something more than merely a screen displaying images of paper scores; as such it is proving to be a more flexible and malleable concept for communicating ideas in music across a broad range of musicians and abilities. Although there is a great range of practices encompassing this field of exploration, there is no single body of discourse that brings these together into a specific and cohesive whole. This is understandable as the field is fresh and exciting with no agreed borders with approaches that transform practices and languages, and meanings for musicians.

There have so far been relatively few theoretical examinations of digital scores. A number of recent studies have discussed notational technology in interactive systems (e.g. Hugill 2018, Hope 2017, Magnusson 2019) but have yet to fully address the digital score as described in this proposal. Studies of electroacoustic and computer music, on the other hand, seem to regard the digital score as peripheral (e.g. Rhodes 2015). Some

texts do discuss the effect of multimedia upon musicianship (e.g. Brown 2012) but fail to apply these to the concept of a digital score; while music-oriented studies of digital culture, gaming and new media (e.g. Collins 2008) do not concern themselves with the music score at all.

The lacuna in the theoretical and practical understanding of the meaning of digital scores is due to the fact that any studies have so far focused on using the signatures of traditional musicology as the benchmark for understanding the digital score. Any new study of digital scores needs to understand how the digital score presents a different set of propositions and signatures to the notion of a music score due to its core involvement with computation and digital media, and therefore is to considered as a new type of music communications interface worthy of its own tradition of inquiry (Agamben 2009), with its own theoretical benchmarking.

The central challenge that this project will investigate is **how digital scores stimulate new relationships between musicians and opens up the possibilities of novel creative experiences; and how these profoundly influence the nature of the digital musician.** The solution therefore needs to look beyond what a score is (technical construction) and study what it does to the musicians inside the flow of the creative acts of musicking: composing, performing, making, designing and coding. Given the computational and digital media nature of these digital scores, this is naturally a trans-disciplinary challenge and needs to draw on theories from music, philosophy, performance, media studies, gaming and software engineering, for example.

The "Digital Scores" project represents a significant step change that will have the potential to reposition digital scores from the margins of music experimentation for a few, to the centre of practice and meaningful engagement for many. It will lead to new forms of practice and musical expression. It will provide a digital space for inclusive music-making. It will present solutions for the publication and distribution of innovative new music and the communication of novel musical ideas in the digital age. It will do this by creating the necessary scientific understanding of both its theory and practice. It will focus on new ways of understanding digital musicianship and the creative affordance of delivering next-stage developments in notions of the music score. The benefits of this research will extend beyond music studies and publishing. It will impact upon computing by establishing new sets of user requirements and providing new models for software development. It will have a direct impact on certain emerging technologies by providing creative input. It will give insights into aspects of cultural heritage (the traditional music score) and how that may be re-materialised and used in contemporary digital culture. It will lead to new understanding of creative processes, performance practice and audience engagement. Furthermore, academic researchers will find great use for the critical outputs of the project, which will define an emerging corpus of digital scores and provide a critical framework for its analysis.

The *high gain* of this project is a transdisciplinary critical understanding of the digital score from within (practice) and without (theorisation), leading to a fundamental reconceptualization of the music score in a digitized world. The *high risk* resides principally in the generation of new knowledge through the creation of artefacts. The practice-based research strand of this project will adopt the artistic research model (Borgdorff 2011) which supports a scientific enquiry into a form of knowledge production enmeshed in the reflexive praxis of doing. The key challenge is the transformation of the 'unfinished thinking' (ibid.) generated by the practitioner-researcher in, with, and through their practice, into new insights and new knowledge that benefit the field. In short, practice, and the artefacts of such practice do not speak-for-themselves and do not constitute new knowledge. It does, however, generate new insights that are 'enclosed in aesthetic experiences, enacted in creative practices and embodied in artistic products' (ibid.). Formal knowledge generated by such practice is then transformed through a rigorous process of evaluation and reflection from the experience of the practice. As such knowledge generated by this project will be set in a specific trans-disciplinary context, examined through scientific processes, against theoretical frameworks in order for new insights to reach beyond the particular cases in order to contribute to knowledge in the round.

Some groundwork for this project has already been established: the PI's own artistic, performance and compositional practice (Vear 2014a&b, Vear 2016a&b, Vear 2004-20) warrants significant confidence as the majority of this project will revolve around developing philosophical and theoretical constructs that arise from artistic-practice research. In 2016, he led a preparatory network event that established a proof-of-concept for the aims and objectives of this project including the innovative methodology. This event was supported by a £3500 grant from De Montfort University under their Higher Education Innovation Fund. In 2017 he was awarded a £10,000 grant from British Academy/Leverhulme Trust for a 2-year pilot study of artistic practice within digital score music systems. In 2019 the PI published the findings from over a decade's worth of practice-based experimentation in this field in his publication of *The Digital Score – Musicianship, Creativity and Innovation* (Routledge 2019). This monograph featured contributions from over 50 significant musicians from 4 continents with the intention to 'initiate a conversation about how the music score is being transformed by digital technology' (Vear 2019). The theoretical framework underpinning this book was based on the argument that musicians working with digital scores are implicitly aware of the inter-relationships of musician-

technology-media-music and its inter-connections from a two-way phenomenology of *affect* and *embodiment*. The research from his book and his artistic research practice sets out the groundwork for this proposal, making the PI uniquely positioned to lead this project.

The PI will lead each aspect of this project, the core research team, and oversee/drive the development of the practical, analytical, and theoretical research processes. He will take full responsibility for the leadership of each work package (WP) throughout this project. He will lead the intellectual development of this research, will conduct the European series of case studies, and lead the experimental studies as part of the Digital Scores Experimental Lab (discussed below). The project team comprises 2 Post-Doctoral Research Fellows, and a project manager who will administer the financial and logistical demands of this project, provide social media support and maintain the Content Management System for the project website.

Given the broad range of aesthetic and artistic approaches to the digital score it is important that this research is conducted not by a single individual but a team of senior researchers from a variety of music cultures and geographic locations. To this end this project will adopt a *hub-and-node* network approach to organising the investigative team and to maximise the potential of research insights. The *node* team members (beneficiaries) are recognised as world leaders in the practice of digital scores and will bring this practice into their research in this project and are cultural and academic leaders not only in their territory (Asia, US, Canada and Australia) but also across the world. They will conduct a programme of research under the leadership of the PI, contribute to the intellectual development of this research, oversee their territories case studies, and conduct their own Digital Scores Experimental Lab (discussed below). The senior research team are: *Australia* – Prof. Dr. Cat Hope is a leading expert on animated notation, mixed-media opera and experimental electronic music performance. *Canada* – Prof. Dr. Sandeep Bhagwati's work focusses on how digital score technologies can be useful and foster musical change for musicians who normally do not work with paper notation during performance. *USA* – Prof. Dr. Kenneth Fields is a world leader in telematic and network music performance and score distribution. *Asia* – Prof. Dr. Li Xiaobing has composed digital scores for multi-media, Chinese opera and small ensembles and has written on the cultural history of digital music in China. The TENOR-Network (Technologies of Notation and Representation) https://tenor-network.org will be the official network for the "Digital Scores" research project. TENOR brings together researchers and institutions around the Technologies of Notation and Representation theme through yearly international events and conferences.

- ***Method***

To achieve the objectives (above) this research programme will be conducted through three complementary and interwoven strands: ***Theoretical Studies*** (objective 2)**,** the PI and the team will bring together a transdisciplinary panel of experts from the digital humanities, software studies, computer science, media arts theory, musicology, and performance studies, to establish and develop a transdisciplinary approach to critical the understanding of digital scores and new forms of music score creativity in the digital age. ***Creative Experiments (***objective 1)**,** comprising the design, development, realisation and dissemination of a series of practice-based case-studies (roughly 50) across different geographic locations and socio-cultural backgrounds and sub-cultures, that examine different emerging technologies as the basis for digital scores. These will be conducted by the PI and other team-members under his supervision, and engage composers, professional and community musicians, and creative technologists in a ground-breaking analysis of their experiences in the flow of music-making with digital scores in real-world audience-facing scenarios. ***Digital Musicianship*** (objective 3), will synthesise the findings from the other two strands and develop an analytical framework for understanding the shifting nature of musicianship with digital scores. This will include a comprehensive programme of interviews with digital score creators and theorists, and engage musicians in practice-based workshops with the emerging corpus of digital score practice. The "Digital Scores" project will unfold in three phases: Preparation Phase (1 year); Experimental Phase (3 years); and Summary Phase (1 year).

- **WP1: Preparation Phase (Year 1).**

This phase will aim to establish the theoretical and organisational bases for the experimental work in the next work-package. ***Task 1****: Theoretical study* will aim to define and situate digital scores within the wider and already substantially theorised fields of digital humanities and media theory. There will be ten fully documented colloquia (detailed in Part B2), which will take place at monthly intervals during the first year and held online as a virtual symposium featuring a series of invited experts (provisional list in part B2) alongside provocations from the project team. These will address the themes proposed by the *affect/ embodiment* phenomenology framework from Vear (2019) (discussed above) and the five dimensions of musicianship posited by Brown (2012) as: 1) *aural awareness,* 2) *embodiment,* 3) *sensation and affect,* 4) *liveness,* 5) *presence,* 6) *representation,* 7) *imagination,* 8) *play,* 9) *time* and 10) *interaction*. ***Task 2****: Interviews and survey of practice*. The PI and PDRF-1 (Music Perception and Cognition) will conduct a series of interviews with practitioners of digital scores and media/ computer artists whose works can be seen as influential to this field. The semi-structured questions will expand the subjective and objective propositions emergent from Task 1 and

will be augmented by theories of musical representation of self and others in joint action (e.g. Keller et al 2016), social cognition of interaction through music performance (e.g. D'Ausilio et al 2015), Empathetic Involvement (e.g. Carr et al (2004)), Embodied Music Cognition (e.g. Leman 2008), and Player Involvement (e.g. Calleja (2011)), as applied successfully in Vear 2019. ***Task 3****: Case Studies Preparations.* The objective of this task will be to plan the experimental phase (WP2) in conjunction with the *node* centres, including relevant working arrangements and the distribution of case studies themes across the network. ***Task 4****: Project website design and build.* The website is a core element of the project, providing not only a storage location and public-facing showcase, but also being the locus for all the theoretical and practical activity.

- **WP2: Experimental Phase (Years 2-4)**.

This phase will comprise a series of practice-based case studies consisting of the creation and analysis of a range of digital score prototypes. Each centre in the *hub-and-node* organisation will host a series of practice-based case studies involving professional, freelance, improvisatory, indigenous, self-taught, outsider, student and community musicians and composers. There will be 5 case studies conducted in each centre (UK/Europe, US, Canada, Australia and Asia) each lasting 6 months (25 in total). The theme for each of these will be different across the network and will be determined in advance by the team to ensure equal coverage of the themes and cross-synthesis of insights. The themes are: *artificial intelligence, machine learning, internet networking, robotics, virtual and augmented reality, gaming* and *physical computing* (detailed in Part B2). The theoretical research that began in WP1will continue through the practice-based experimentation of WP2. The artistic-practice will follow the iterative loop process of *{design, development, test, refine}* and the critical reflection process will support feedback between the practical invention and theoretical development. This will involve each *hub-and-node* centre interviewing the participants of their case studies using the interview structure defined in Task 2 of WP1. These insights will be collected frequently and at regular intervals (monthly) in order to critically inform the development of each case study. The case studies will not result in fully finished commercial compositions: these are to be experimental prototypes that are designed to investigate key research questions. However, they will be performed across the network as part of the critical reflection process and then published during WP3.

Running alongside the main experimental phase will be two complimentary tasks: ***Task 1****: Digital Score Experimental Labs (D-SEL)*. Each centre (UK/Europe, US, Canada, Australia, Asia) will run a D-SEL supporting each team members (beneficiary)'s own research practice in digital scores. The aim of this task is to experiment with the ideas that emerge from the theoretical and artistic practice research of the "Digital Scores" project as a series of practice-based prototypes (nominally five in each, across the life of WP2). The ethos of D-SEL, will be experimental and risky, going beyond the parameters of what might be considered a 'music score' so that the project can explore the boundaries of meaning and the associated transformations of musicianship (composition, performance, coding, designing, making etc). The PI has a long-standing reputation of innovation and risky play in music composition and is therefore is well positioned to lead this task across the network. ***Task 2****. Road show.* The PI and PDRF-1 (Music Perception and Cognition) will visit each centre of the *hub-and-node* network over this work-package (years 2-4). The primary objective is to engage undergraduate and post graduate students and their community of local musicians from a range of backgrounds and abilities in the corpus of the digital score, evaluate their musicking (composing, coding, performing), and to examine their wants and needs from digital musicianship education.

- **WP3: Summary Phase (Year 5)**.

This phase will see final publication of the creative experiments, academic outputs, and all the documentation. ***Task 1****: artistic outcomes.* This task will concentrate upon the publication via the website of outcomes from the experimental Case Studies and D-SEL e.g. 50 new digital score compositions and associated performances. ***Task 2****: academic conference including final concerts.* The final academic conference will be a two-day event held at De Montfort University. It will be aimed at practitioners, academics, computational technologists and the music publishing industry. ***Task 3****: academic outcomes.* The academic outputs will focus on three main platforms: ***A)*** a co-authored book edited by the PI on the topic of *Digital Musicianship* to be published by Routledge (the PI has a standing contract with Routledge). Each member of the team will contribute a chapter within a themed structure created around the main research questions that were addressed in the experimental Case Studies. The PI will also complete a second edition of his book *The Digital Score* which will update and expand the corpus used to illustrate the book, and add a new section on intelligent digital scores. ***B)*** Throughout the "Digital Scores" project the PI, PDRF's and the team members will seek to disseminate academic papers at appropriate and strategic points in the process, such as in peer-reviewed research journals including the *Contemporary Music Review; Digital Creativity; Leonardo;* and conferences such as International Computer Music Conference and CHI (human computer interaction). ***C)*** The public-facing website and database of digital scores will provide online tools and resources alongside information and analysis; full documentation of each project, including movies, audio and multimedia content and, where possible, the complete performances.

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Section b: Curriculum vitae (max. 2 pages)

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CURRENT AND PREVIOUS POSITIONS: 2016- Professor of Digital Performance (Music). 2014-16 Reader in Performing Arts (Music). 2011-14 Senior Lecturer in Performance and Digital Arts. 2008-11 Associate Lecturer in music composition, Salford University. 2004-6 Associate Lecturer in music technology, Exeter University. 1992- Professional composer

INSTITUTIONAL RESPONSIBILITIES: 2019 senior research fellow, Institute of Creative Technologies. 2018 Director of Creative AI Research Group. 2018 Programme Leader for PhD in Practice-Based Research. 2015-18 Site Director for DMU in Arts and Humanities Research Council (AHRC) Midlands 3 Cities Doctoral Training consortium. 2014-16 Head of Performance Research Group Faculty of Art, Design and Humanities, DMU. 2014- Member, Faculty of Art, Design and Humanities Research Committee, DMU. 2014-16 Member, Faculty of Art, Design and Humanities Ethics Committee, DMU. 2014-16 Member Research Excellence Framework 2020 Metrics working group; 2011-16 Member, Music, Technology and Innovation Research Centre committee

COMMISSIONS OF TRUST: 2018-present Editor-in-Chief *Cultural Computing* Springer Series (2018-2020 as Deputy). 2016-2020 member of AHRC Peer Review College. 2016 PhD External examiner, University of Sussex. External reviewer: School of Music senior lectureship promotion round, Maynooth University, Ireland. 2015- Editorial Board, *International Journal of Performance Arts and Digital Media*. 2015- External Examiner, MMus Composition, MMus Performance, MMus Creative Sound and Media Technology; MMus Songwriting, Bath Spa University, UK. 2015 Reviewer, *International Journal of Creative Computing* (Inderscience). 2015 Reviewer, *Research in Drama Education* (Taylor and Francis; x2). 2015 Reviewer, *PeerJ* (Independent). 2014 Reviewer, *Organised Sound* (Cambridge University Press). 2012 Guest Editor, *International Journal of Performance Art and Digital Media* (Taylor and Francis) Special Edition *Digital Opera.* 2011 Consultant, Curve Theatre Network Project with Creative Partnerships, UK. 2008-11 Director, Adelphi Contemporary Music Group, Salford University, UK. 2008 Advisor, BBC Philharmonic Orchestra/ Leverhulme Wonder: a Scientific Oratorio. 2007 Consultant, 2012 Cultural Olympiad Artist taking the Lead steering committee. 2005 Member, Arts Council England/ British Antarctic Survey Fellowship selection committee.

CONTRIBUTIONS TO RESEARCH LEADERSHIP: 2016-2019 Site Director. AHRC Midlands 3 Cities (M3C) Consortium overseeing the £14.6M AHRC Doctoral Training Partnership grant for De Montfort University. 2015-16 Coordinator. Research Excellence Framework 2020 unit coordinator for Faculty of Arts, Design and Humanities at DMU. 2014-15 Principle Investigator. *Pop-up Play* (NESTA) - £105,000. Team: 6. 2013 Head of *Performance Research Group* (School of Arts) Supervising 33 academics (including 1 Professor and 2 Readers). 2011-13 Co-Director *Digital Opera Research Group*, DMU. 2011-13 Chair. *Intermediality and Performance Research Group* (School of Arts), supervising 7 researchers, a national symposium at DMU (July 2013), and a performance series. 2010-12 Principle Investigator. *A Sentimental Journey – A Digital Opera* - £11,000. Team: 12. 2005-8 Principle Investigator. *Singing Ringing Buoy* - £27,000. Team: 6.

ORGANISATION OF SCIENTIFIC MEETINGS: 2016 Organiser/ scientific chair, *Kyma International Sound Symposium*, De Montfort University, UK. 2013 Organiser, *Digital Opera Research Network*, DMU. 2011 Organiser, *Digital Opera: New Means, New Meanings*, University of York, UK

PUBLICATIONS (selection. * denotes most relevant to this application)

Written Publications

Vear, C. (Ed.) (2021) *The Routledge Handbook of Practice-Based Research*. London: Routledge (in pre-production)

Vear, C. (2016) 'Pop Up Play: A Digital Creative Play Space.' *Digital Creativity* (Routledge) 27 (4): pp TBC.

* Vear, C. (2016) 'The Gesamtkomposition of Digital Opera: A Sentimental Journey'. *International Journal of Performance Arts and Digital Media* (Taylor and Francis). Issues 12.1: 61-81.

Vear, C., McConnon, L. *"Put me back in my skin!" Children's Perceptions of Mixed Reality Play.* International Journal of Scientific and Research Publications, 5 (6).

* Vear, C. (2014) 'Music, dimensions and play: composing for autonomous laptop musicians and improvising humans.'. *Digital Creativity* (Routledge), 25 (4), pp. 343-356.

* Vear, C. (2014) 'Exploring the Creativity Code – investigations into the use of Fuzzy Logic and Artificial Intelligence in the composition of hypermedia performance.' In ed. Davismoon, S. *Immersive, Interactive, Real and Imagined Sonic Environments: Encountering the Aural Muse in Imagined, Implied Spaces, in Intelligent Technologies for Interactive Entertainment: 6th International Conference,* INTETAIN 2014 Proceedings, Springer, pp.115.

Research Monographs

* Vear, C. (2019) *The Digital Score: Musicianship, Creativity and Innovation.* New York: Routledge
* Vear, C. (2015-) *Software Scores 2008-2020*. Composers Edition.

2004 *Antarctica: Musical Images from the Frozen Continent* (includes DVD). Published by Earth Ear (US), Gruenrekorder (Germany)

Commissions, Performances and CD publication of Musical Compositions

* 2019 *Black Cats and Blues*. CD. Performed by Craig Hultgren. Metier Records, USA.
* 2018 *On Junitaki Falls*. Commissioned by Christopher Redgate. Premiere Florence, Italy (Dec 2017)
* 2017 *Postcards*. Commissioned by Anne La Berge. Premiered Oslo 2017

2014 *Quicksilver*. Commissioned by Kyma International Sound Symposium. Premiere: Lubeck, Germany

* 2012 *A Sentimental Journey* (Digital Opera) Commissioned by The Laurence Sterne Trust, Arts Council England, York Theatre Royal. Premiere: York Theatre Royal, UK

2012 *Like A Fish Out of Water.* Commissioned by English National Ballet, 2012 London Cultural Olympiad. Performed in London as part of 2012 London Olympics

* 2012 *Three Last Letters*. Commissioned Vale of Glamorgan International Music Festival. Premiere: Cardiff

2012 *Esk* (CD). Published by 3 Leaves (Hungary)
2011 *Antarctica* (CD). Published by Gruenrekorder (Germany)
2010 *Summer Houses*. (CD). Published by Mille Plateuax (Germany)
2010 *Aud Raplh Roas'le* (CD). Published by Mille Plateuax (Germany)

Invited presentations to peer-reviewed, internationally established conference

* 2019 Invited Paper. *Embodied Robotic Music* Hybrid Practices Conference, Malta, March 2019
* 2017 Invited Keynote. Kyma International Sound Symposium, Oslo, October 2017
* 2014 Invited presentation. 'Exploring the Creativity Code - Investigations into the use of Fuzzy Logic and Artificial Intelligence in the composition of Hypermedia performance.' INTETAIN 2014, 6th International Conference on Intelligent Technologies for Interactive Entertainment

2014 Invited Keynote Plenary. 'Opera on Web and Mobile Platforms. Opera and the Media of the Future Conference at Glyndebourne Opera

Prizes/ Awards/ Academy memberships

2011 Winner - OLIVIER Award Best Entertainment (as core design team for Railway Children)
2011 Nomination - Canadian DORA Award Best sound design and composition

* 2009 Finalist - VII CONFLUENCIAS – electroacoustic competition

2006 Winner - Antarctica. Music DVD Excellence – DVD Association Awards, Los Angeles,

* 2005 Runner-up - PRS Foundation £50,000 New Music Award

FUNDING

2016 De Montfort RIF fund – Digital Performance £3000 (PI). 2015 De Montfort Higher Education Innovation Fund for Research Network – AI and music £3000 (PI). 2014 National Endowment for Science and The Arts/ AHRC/ Arts Council England Digital arts R&D fund £105,000 (PI).2012 *Three Last Letters* production budget, Vale of Glamorgan Festival £11,000 (PI). 2012 English National Ballet commission £3,500 (PI). 2012 South Bank Centre commission £2,500 (PI). 2011 *Found Voices* Tipping Point Commission, R&D £10,000 (co-PI). 2010 *A Sentimental Journey* R&D – ACE Grants for the Arts £2,000 (PI). 2009 *Superfield [Mumbai]* commission, Bradford City Council £9,000 (PI). 2008 Research Bursary University of Salford: £40,000 (PI). 2007 Leverhulme Fellowship - Artist in Residence: £12,000 (PI). 2006 *Singing Ringing Buoy* – R&D, Gulbenkian Foundation: £7,000 (PI). 2005 *Singing Ringing Buoy* – ACE Grant for the Arts: £15,000 (PI). 2005 *Ice age* Exhibition, Museum of York – York Museum Trust: £5,000 (PI). 2004 *Antarctica* DVD/Book – ACE Grant for the Arts: £15,000 (PI). 2004 *Falklands Suite* project and CD –Shackleton Fund: £8,500 (co-PI). 2004 *Rime of the Ancient Mariner* exhibition – ACE Grant for the Arts £4,500 (PI). 2003 *Antarctica Fellowship* – NERC/ ACE International Fellowship: £4,000 (PI)

CAREER BREAK

After graduating with first degree in 1992, I pursued a career as a freelance researcher in music composition, interdisciplinary theatre and digital performance. Following 20 years of pioneering artistic practice, I consolidated this research into a PhD (2008-11). After successfully defending my thesis I became a full time academic, leading to a personal chair of Professor of Digital Performance (Music) in 2016.

Appendix: Current research grants and any on-going applications related to the proposal of the PI (Funding ID)

Mandatory information (does not count towards page limits)

Current Grants

Project Title	*Funding source*	*Amount (Euros)*	*Period*	*Role of the PI*	*Relation to current ERC proposal*[1]

On-going and submitted grant applications (Please indicate "None" when applicable):

Project Title	*Funding source*	*Amount (Euros)*	*Period*	*Role of the PI*	*Relation to current ERC proposal*[2]

[1] Describe clearly any scientific overlap between your ERC application and the current research grant or on-going grant application.

Section c: Early achievements track-record (max. 2 pages)

- **Introduction**

For more than two decades Professor Dr. Vear has established himself as an internationally recognised composer of experimental music with technology, and recently as a scholar of digital performance and music. His research is naturally hybrid as he draws together the fields of music, digital performance, creative technologies, AI, gaming, mixed reality and recently robotics. He has been engaged in practice-based research with emerging technologies for over two decades. His software scores are published internationally by Composers Edition, and he is editor-in-chief of Springer's *Cultural Computing* Series. His recent monograph *The Digital Score: Creativity, Musicianship and Innovation*, was published by Routledge NY in spring 2019, and he has twice been shortlisted and interviewed for European Research Council *Starting Grants* (2017 & 2018).

His research operates on a dual thematic axis of 1) digital creativity in music performance, and 2) innovation in the use of digital music in performance. Peer reviews of his contribution to this field have commented on how his research is 'a major point of reference in computer music interactivity, live composition and improvisation'*;* 'enhance practice by creators and researchers in interactive composition' … 'particularly in the case of ensembles involving human and computer performers'*;* 'will enhance thinking and practice by creators and researchers'. (UK Research Excellence Framework 2014 external audit). Furthermore, anonymous peer reviews of his journal articles by international academics include: 'Where the author's work is most unique, I think, is in the live interaction between human players and pre-programmed computers.' (*Digital Creativity* Denmark/ US); and how his theoretical analysis 'stands to exemplify a set of procedures and interrelations, both aesthetic and technological, relevant to both fields (digital opera and digital scores)' (*International Journal of Performance and Digital Arts* EU/ US).

- **Publications**

Professor Dr. Vear has performed his digital score compositions widely throughout the world. His entire collection of software scores (2008-20) are published through Composers Edition (CE) a music publishing company specializing in living composers of international significance. This places his published compositions together with other eminent composers at CE such as: Professor Michael Finnissey (Professor of Composition at the University of Southampton); Professor Martin Iddon (Head of School and Professor of Music and Aesthetics, Leeds University); Professor Richard Baker (Professor of Composition at the Guildhall School of Music & Drama); Professor John Palmer (Professor at the University of Music of Stuttgart); Professor Roger Redgate (Professor of Composition at Goldsmiths, University of London).

Significant international organizations have commissioned his monograph compositions as exemplars of innovation. It is important to note that commissions of this nature and significance are the practice-based equivalent of Keynote invitations. Selected examples are: **2003** *Stretch* music and sound installation, commissioned by Chicago Humanities Festival (the largest annual festival for arts and humanities, since 1990 has become the largest organization of its kind in the world). **2005** *Falklands Project* large-scale composition for musicians and digital technology, commissioned by Falkland Islands Government. **2009** *Superfield Mumbai* electroacoustic composition, commissioned by Mumbai Festival, India (largest 10-day festival of International Culture and art in Maharashtra). **2012** *Like a Fish out of Water* soundtrack for iPad app performance, commissioned by 2012 Cultural Olympiad/ English National Ballet. **2012** *Poetry Parnassus* solo sound installation, by 2012 Cultural Olympiad /South Bank Centre (SBC est. 1.5 million audience). **2012** *Three Last Letters* large-scale composition for 9 musicians, commissioned by Vale of Glamorgan International Festival (festival of contemporary music since 1969, known for its engagement with significant international living composers). **2011** *A Sentimental Journey* a Digital Opera commissioned by Arts Council England, Laurence Sterne Trust and published by Composers Edition, was cited in the *Cambridge Companion to Opera Studies* (Till, N ed. 2014) as an exemplar of how 'the future may involve very different concepts of the performance space of opera, and of what constitutes an operatic audience or an operatic event'.

He has published his scholarly texts exclusively in leading international peer-reviewed journals such as *Digital Creativity* and *International Journal of Performance Art and Digital Media*. Digital Creativity (Taylor and Francis – Routledge), for example, is a major peer-reviewed journal at the intersection of the creative arts and digital technologies. In 2014, he was invited directly by the scientific panel to present at INTETAIN (International Conference on Intelligent Technologies for Interactive Entertainment). This monograph paper was later published in Davismoon, S. (ed.) *Immersive, Interactive, Real and Imagined Sonic Environments: Encountering the Aural Muse in Imagined, Implied Spaces, in Intelligent Technologies for Interactive Entertainment: 6th International Conference,* INTETAIN 2014 Proceedings, Springer, pp.115, and currently has over 400 downloads.

His book *Digital Scores* has sold over 500 copies in the first year of release. In 2018 he was invited to become Deputy Editor-in-Chief for the *Cultural Computing* Springer Series, and was made full Editor-in-Chief

in 2020. He is a full member of the editorial board for *International Journal Performance Arts and Digital Media* (since 2015) and *International Journal of Creative Computing* (since 2018), and in 2012 was guest editor for their Digital Opera special edition. Additionally, Professor Dr. Vear has been awarded significant Research Councils UK-funded fellowships enabling a concentrated period of practice-based research on specific projects. For example, in 2007-8 he was awarded a 12-month Leverhulme Trust Fellowship with the Centre for Environmental and Marine Sciences (University of Hull), investigating acoustic ecology and digital performance (Value: £12,000). In 2003-4 he was awarded the first three-month residency with the British Antarctic Survey (NERC/ ACE funding), in which 65 national artists applied for this post (Value £4000).

- **Research Leadership**

In 2014 he was awarded £105,000 as PI on a Digital R&D for the Arts research project that developed an innovative mixed reality system that enabled children and young people to engage in creative digital play for enhanced learning and communication skill development. The funding was granted through a consortium of AHRC, National Endowment for Science and the Arts, and Arts Council England, and beat 105 other applications for the award. The project was in partnership with Spark Arts for Children, DotLib creatives and DMU, and in association with 5 schools across the country and 3 arts organisations. The technological and his theoretical outputs from this project have been advocated by teachers, dance practitioners, arts organisations, special needs schools, libraries, learning officers, museums and youth workers. The project was described as an 'excellent example of how we can deliver quality principles in an innovative digital gallery learning project' (education officer, Attenborough Arts Centre). http://artsdigitalrnd.org.uk/projects/the-spark-arts-for-children/

He is co-director of the Creative AI Research Group (8 members) in the Institute of Creative Technologies, UK, where he also leads and directs the Doctoral (PhD) Programme for Practice-Based Research and the Doctoral Training Programme for Practice-Based Research. He has been commissioned by Routledge as Editor-in-Chief for *The Routledge Handbook of Practice-Based Research*, due for publication in 2021. He is director of research for the Institute, and leads De Montfort University's partnerships with the Creativity and Cognition Studios at the University of Technology Sydney, Australia. The CCS network (executive network director Prof. Dr. Ernest Edmonds) brings excellence to practice-based research with a specific focus on creative technologies. It supports practice-based research at PhD level through an innovative programme of study, and supports/mentors PbR staff working across the arts, design and humanities aswell as computation, business and law and the applied health sciences.

He was PI (with co-investigator Prof. Dr. Michael Young) on a DMU funded project (value £3000), entitled *New Perspectives in Artificial Intelligence and Music,* which investigated embodied cognition as a philosophical approach to composing with A.I. This network brought together 15 partners including BBC, University of Malta, University of Gant, and Sussex, Newcastle, Goldsmiths, Bath Spa Universities.

Between 2015-19 he is Site Director for the AHRC Midlands 3 Cities (M3C) Consortium overseeing the £14.6M AHRC DTP grant for De Montfort University. In 2015 he was interim REF2020 UoA35 coordinator for ADH. In 2013, he was appointed Head of Performance Research Group (School of Arts). Through this position he achieved: leading the strategic development of the research group within the faculty; leading and developing and implementing research group plans; monitoring and manage research group performance, increasing research submission by 600% from REF2014; working with the Head of Research and Research Excellence Framework (REF) coordinators on the REF preparations, with increase from 2.5 submission in REF2014 to 12 in preparation for REF2021; working with the Research and Innovation Office in the Faculty on developing proposals for research funding and/or external income generation within the research group: total value over period 2013-15 in excess of £105,000; mentoring ECRs with two members successfully completing the Future Research Leaders Scheme; and supervising PhD recruitment, increasing PhD by 20% including 1 full scholarship. Alongside this, he is also a member of Metrics Project Board (from 2014), Faculty Research Committee (from 2013), and between 2011-13: created the Intermediality and Performance Research Group (School of Arts), appointed Chair with supervision of 7 researchers, a national symposium at DMU (July 2013), and performances.

He has also established a reputation for research leadership in the professional sector. Significant case studies in which he was PI and that were delivered on time, with all stakeholders 100% happy with the outcome and 100% of research partners satisfied with the process include: *Pop-up Play* (2014-15) - £105,000 (Role PI) Team: 6, in partnership with Spark Arts, Leicester. *A Sentimental Journey – A Digital Opera* (2010-12) - £11,000 (Role: PI) Team: 12. Funded by Arts Council England, York Theatre Royal, University of Salford, and Laurence Sterne Trust. *Singing Ringing Buoy* (2005-8) - £27,000 (Role: PI) Team: 6 A site-specific computer-music installation hosted in collaboration with the National Maritime Museum Cornwall (2007-8). Funding was by a portfolio of Gulbenkian Foundation, Arts Council England, PRS Foundation, and University of York. Technical services supplied by the Music Research Centre, York.