

DARK MATTER IMPACT EVALUATION REPORT

FLOW ASSOCIATES, NOVEMBER 2019



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INTRODUCTION

ABOUT THIS REPORT

Flow Associates were commissioned by Science Gallery London to conduct audience evaluation for HOOKED, SPARE PARTS and DARK MATTER, the three seasons happening during their first year of operating. This evaluation focused on visitor demographics, motivation, and reaction to the exhibitions. Alongside this Flow were asked to conduct a deeper impact case study of DARK MATTER, which would be used to inform King's College London's Physics department's REF impact case study, specifically looking at the work of Season Advisor and Theoretical Physicist Malcolm Fairbairn.

This report focuses on the DARK MATTER season and combines insights gathered via visitor surveys, observation, and a series of impact interviews with people who have collaborated on or visited the exhibition. Through this we ask: 'What impact did the DARK MATTER exhibition have on visitors, collaborators and Science Gallery London itself, and how did the input of King's researchers feed in to this?'

METHODOLOGY

This report draws on insights gathered from:

- 1260* responses to the exhibition survey, representing 3.4% of the exhibition visitors.
- Audience feedback gathered at five events
- Interviews with 18 visitors
- Interviews with Science Gallery London staff, including the Head of Programming Jen Wong, and Season curator Sandra Ross
- Interviews with four artists, three of whom created new work for the exhibition
- Interviews with a participant and facilitator at a youth led workshop responding to the theme of Dark Matter
- Interviews with Science Gallery Young Leader Laura Joy Pieters, and their lead Mediator Lauren Angelkov Cummings

*A note on the survey data:

Our Year 1 visitor survey was adapted for DARK MATTER to include more open questions about the subject of dark matter and visitors reactions to specific art works. Questions were rotated throughout the exhibition run to ensure we could gather a range of responses without significantly increasing the length of the survey.

The survey was completed on a stand-alone unit, which resulted in a higher than usual response rate with 2098 entries. The lack of supervision has had an impact on the quality of the data, resulting in:

- Low completion rate, only 67% answered the demographic questions so some responses have little context.
- Unreliable/skewed data. At least 2% of people who did complete gave fake or nonsense responses. While this may seem low, these people were more likely to give a false age at one end of the scale (e.g. Under 15 or 64+) or identify their gender as something obscure (e.g. a chair leg).

We have controlled for this in our analysis by being conservative about the number of responses we can draw conclusions from, and comparing data with previous seasons. Even with this taken into account the volume of data is greater than previous exhibitions.

EXECUTIVE SUMMARY

DARK MATTER was Science Gallery London's most complex, successful and profitable exhibition and events season to date. The programme ran from June 6th to August 26th 2019, attracting 37,344 visitors and thus raising awareness of the research happening at King's College London into dark matter and theoretical physics. In addition, sales figures from the Science Gallery shop show a 30p increase in spend per head from the previous exhibition SPARE PARTS, which combined with higher visitor numbers has resulted in a 66k uplift in profit.

The close collaboration between King's researcher Malcolm Fairbairn, who acted as Season Advisor for DARK MATTER, and season curator Sandra Ross has resulted in an exhibition of work selected to encourage visitors to question their understanding of matter and physics, interpreted in a robust way that enables visitors to form their own ideas. Three Artists collaborated with Malcolm to create new work specifically for the exhibition. These works explore the processes and tools used by Malcolm and his team, drawing comparisons with society. By gaining an understanding of Malcolm's research techniques the artists have developed understanding of their own creative practice, and the confidence and ability to explore complex subjects and address the uncertainty of modern life.

SGL are now equipped with a methodology which will enable them to tackle other complex subjects in future. For example by working in an in-depth way with one season advisor. In addition Mediators working on the exhibition have included Physics PHD and students for the first time, deepening engagement with visitors and enhancing the knowledge of the front of house team.

Key audience data

Science Gallery London attracts a young audience, with a gender split that is marginally more female than male. In line with the ethnicity of London the majority of visitors (65%) are white.

- The age split for DARK MATTER reflects that of previous exhibitions, with 32% within Science Gallery London's target age group of 15 to 25. One difference was in the number of responses from young people aged 15 and under, which rose from 1 or 2% to 12%.
- The gender split for DARK MATTER was slightly more male than the other year 1 exhibitions.
- The ethnicity of the survey respondents was in line with the other Year 1 exhibitions.
- 24% of respondents are linked in some way to King's College London as students, staff, or their friends and family.
- For 81% of respondents this was their first visit to Science Gallery London, and 51% were not aware of Science Gallery London before visiting.

What motivated people to visit DARK MATTER?

- The biggest motivation was interest in subject matter (49%), followed by the combination of art and science (31%). Other reasons included visiting with friends, or simply walking past and seeing the signage.
- Under 15s and 15 to 18 year olds were most likely to say that wanting to find out about dark matter was their main reason for coming, suggesting that this youngest age group are motivated by learning more than other ages.

What might this experience change for them?

- 397 people responded to the question *Can you tell us something you know now that you didn't before?*
 - 58% indicated that they had gained awareness, knowledge or understanding of Dark Matter.
 - 28% focused more on awareness of the artists or art pieces involved.
- 213 people responded to the question *Is there anything this might change in your life work or interests?* 52% of these told us that their experience of DARK MATTER would inspire or support them to make a change.

DARK MATTER: IMPACT AND REACH

“Just at the entrance and then again at the end there is a big question about how you deal with the voids in your life. I thought differently on the way in and out – philosophical in, more concrete out. It became a broader question: how do I deal with the invisible?” (Female visitor, aged 26 to 34)

Dark matter is a hugely complex subject which the general public has little understanding of. More generally, in an increasingly complex and uncertain world, in which decisions can be made in response to popular feeling rather than critical thinking and expertise, the topics of dark matter and other profoundly uncertain enquiries can stimulate public understanding of how and why the unknown is investigated. More specifically, dark matter is a fascinating and expansive subject which attracts the public to explore theoretical physics and particular questions about the origins and nature of the universe.

Science Gallery London had an ambition to produce a season exploring this, but lacked the in-house knowledge or expertise to do so, and new artist commissions needed depth and rigour. Head of Public Programmes Jen Wong approached Malcolm Fairbairn in 2016 and invited him to be involved as a season advisor. This is usually a light touch role, but in the case of DARK MATTER Malcolm was the only season advisor with knowledge of Theoretical Physics, so his input as co-creator was essential. From collaborating with season Curator Sandra Ross to define the narrative structure of the exhibition, to selecting art pieces, collaborating with artists on new commissions, briefing the Science Gallery London team and ensuring exhibition text and labels were robust. Malcolm’s input enabled Science Gallery London to tackle dark matter on a deeper level than they have for previous subjects, and this new mode of working will enable them to address similarly complex subjects in future. The resulting exhibition attracted their biggest audience to date, both for the exhibition and the events programme.

ARTISTS AND CREATIVE PRACTITIONERS HAVE CREATED ORIGINAL PIECES, DEVELOPED THEIR PRACTICE AND WIDENED THEIR AUDIENCES.

Three new artist commissions were produced in collaboration with Malcolm. Artists Yu-Chen Wang, Aura Satz and Agnieszka Kurant each had several conversations with Malcolm during which time he expanded their understanding of Dark Matter research and supported them to interpret this in their own way. He also connected the artists to other experts in his field, including Chris McCabe, John Ellis, Mairi Sakellariadou, Diego Blas and David Marsh. The artists we interviewed all reported that as a result they feel more able to work with scientists in future.

A case study for each artist can be found in the appendix of this report, but in summary:

- Yu-Chen had previously worked with experimental physics but had felt unable to tackle the more theoretical side of dark matter. She commented that she had gained an insight into her own practice through the similarity between Malcolm’s way of searching for answers and hers, and how this gave her confidence that as an artist she has a valid voice on the subject. The resulting piece represents her own investigation into dark matter alongside the work of researchers. She took part in a panel discussion at Science Gallery London and plans to do more work in her home country Taiwan about scientific discussion. She reported that her work has been seen by a wider range of people ‘outside of the usual art crowd’.

- Audio visual artist Aura Satz was able to take her existing approach and apply this to a field of science that was completely new to her. Through drawing parallels with Malcolm 's research techniques she was able to describe her own practice as “experimental listening” and this has created an opportunity for her to move away from historical or factual interpretation towards something more forward looking.
- For Agnieszka Kurant this new commission led her to explore a new area of science. She came to the collaboration with ideas about the different phases of matter, and using this to explore human society. Malcolm's suggestion of using liquid crystal to visualise this led to a very successful art piece which has since been exhibited in Istanbul and further shows are planned in San-Francisco and at Science Gallery Dublin. She hopes to continue her collaboration with Malcolm, and is in conversation with [Esther Lesley](#), a researcher based at Birkbeck who plans to write about Agnieszka's use of liquid Crystal.

In addition to the artists themselves, Season Curator Sandra Ross has been able to produce a show that covers concepts and ideas that went beyond her own previous experience, and conversations with Malcolm opened up new directions for her to explore.

“Malcolm's very close working with the curator meant that we were able to have a truly integrated art science collaboration, at the level of the interpretation but also in the commissioning and selecting of the art works.” John O'Shea, SGL Associate Director (creative)

This has had a lasting impact on Sandra's relationship with Physics and dark matter, and she hopes to explore the subject again.

“He [Malcolm Fairbairn] was absolutely fundamental in shaping the show because his discussions weren't just about ‘this is how Dark Matter is’ they did start going on a more exploratory and philosophical terrain and that helped me to find interesting ideas to explore the subject matter.” (Season Curator Sandra Ross)

“Malcolm has had a profound impact on my curatorial practice and interests.” (Season Curator Sandra Ross)

There is also potential impact for artists who attended as members of the public. We interviewed one visitor who described herself as both an artist and a researcher. She described how some of the artworks, specifically those of Aura Satz and Carey Young, had given her inspiration and an insight into what Science Gallery London might be looking for in a future open call.

“I am a psychology PHD and budding artist looking to work at the interface. This gave me ideas about how to approach unfamiliar concepts in a creative way” (Anonymous visitor)

“DARK MATTER has made me realise that whatever the title is, think of an angle that is relevant to me rather than what Science Gallery are looking for” (Anonymous visitor)

VISITORS TO THE EXHIBITION ARE MORE AWARE OF DARK MATTER RESEARCH, AND HAVE AN INCREASED INTEREST IN A COMPLEX SCIENTIFIC TOPIC.

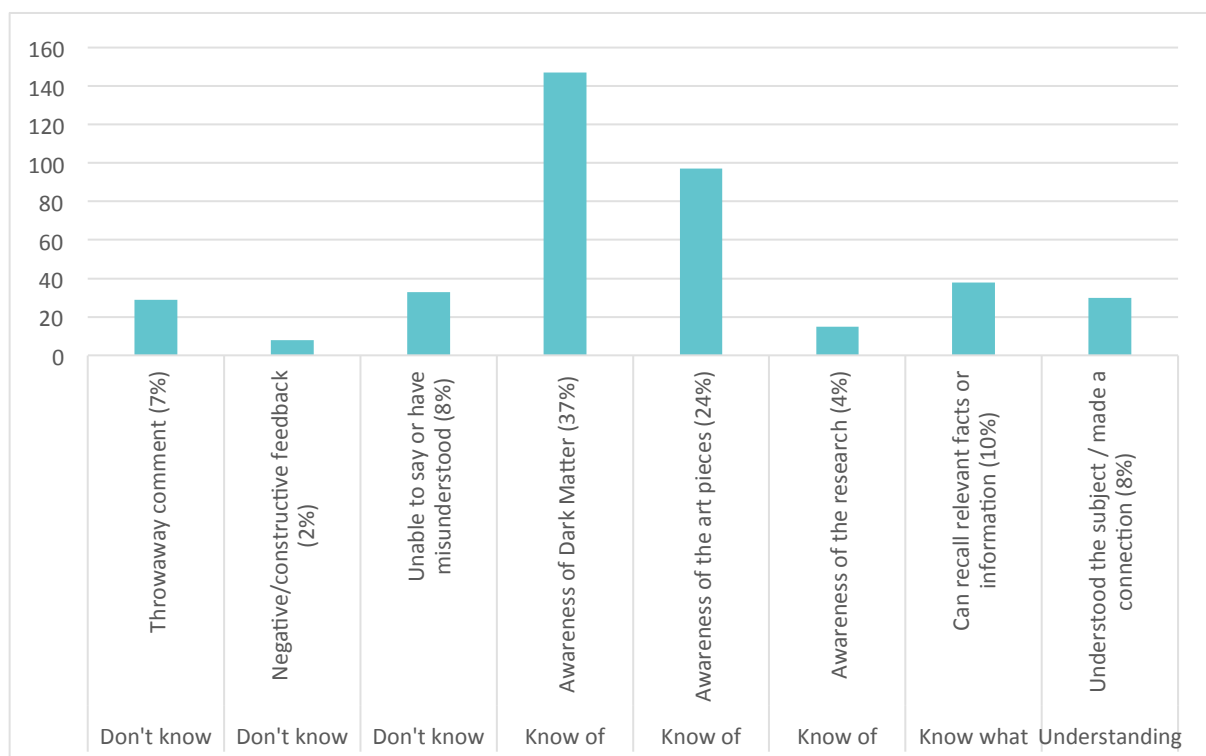
“It helped me realise how much Physics and stuff like Dark Matter is not something that is separate from you. Especially things like the cartoon which illustrated how physics is the ‘butt of the joke’ and that even when we don’t understand it we find it funny because we have an almost innate understanding of physics” (Philosophy student aged 25, who also said she had not engaged with physics at school)

37,344 people visited the DARK MATTER exhibition. Curiosity about the subject matter drew people in, with evaluation indicating that 49% were most motivated to attend by the subject of Dark Matter (as opposed to a general interest in art and science, or discovering the exhibition by chance). For 81% of visitors this was their first visit to Science Gallery London.

The range of events run as part of the season allowed for a wider pool of visitors to engage. Feedback from 169 participants at 6 events tells us that those attending the performances were more specifically motivated by the subject of dark matter, and more likely to study or work in science. Workshop participants most motivated by the combination of art and science, followed by general interest and the subject of Dark Matter. Friday Late audiences were motivated by entertainment or social experiences, followed by dark matter, then general interest or curiosity.

Experiencing dark matter research through the content, curation and interpretation of the exhibition has caused people to feel curious, intrigued, thoughtful, engaged and inspired, with 91% of respondents choosing at least one of these words from a survey. 400 people responded to a survey question asking, ‘can you tell us something you know now that you didn’t before?’. Of these 58% indicated they had gained awareness, knowledge or understanding of Dark Matter or how researchers are searching for it, while 28% focused more on awareness of the artists or art pieces involved.

[I now know] “That the world is made up of so much dark matter but we have no or very little evidence of it, it’s like the great mystery of the universe. Also about all the islands that were mapped but not real, which helped to put it in context” (DARK MATTER visitor)



People who have engaged more deeply, for example through events or reflective conversations about the exhibition, have said they enjoyed how the exhibition was designed to make them think, and as a result they feel more open to exploring and discussing physics.

“I didn’t study science at school because I felt like there’s so much you have to learn about what other people have discovered that I felt there’s not enough room to discover for yourself. Now I realise there’s so much possibility and so many unknowns” (Technology foresight strategist, female, aged 26 to 34)

“It made me realise how much I like science and it made me feel very small in a universe still to discover” (Event participant, Friday Late Elemental)

While it is difficult to assess long term impact through a survey or interview that takes place during or soon after a visit, 213 people responded to a survey question asking ‘Is there anything this might change in your life work or interests’, and 52% felt that at the very least their general interest or curiosity about dark matter had been raised, and of these, 14% told us of a new perspective they have gained through the exhibition.

“Watch more cartoons! Seriously the old ones really are the best and I’m in my mid thirties so can have a new found appreciation for them from a science perspective” (DARK MATTER exhibition visitor)

“I’m more interested in science than I thought. At school I hated science. I found it boring and didn’t enjoy it. Now I’m thinking that I’m not so stupid.” (Event Manager, Female, aged 35 to 44)

YOUNG PEOPLE HAVE BEEN MOTIVATED TO EXPLORE THEIR WORLD THROUGH PHYSICS/DARK MATTER

A key audience for Science Gallery London is young people aged 15 to 25, and our audience survey suggests that 33% of the visitors to DARK MATTER were within this age group. Their responses to questions about motivation and change coming about through the exhibition were not significantly different from other age groups, although under 15s and 15 to 18 year olds were more likely to say that wanting to find out about dark matter was their main reason for coming, suggesting that this youngest age group are motivated by learning more than other ages.

Several of the young people that we interviewed were extremely motivated by Physics itself, and considering studying it at A-Level or higher education. For them the exhibition was a surprise in that it invited them to think and explore the subject for themselves, rather than the more didactic style of a physics lesson.

“I thought it would have a lot more science, but the fact it didn’t made it more thought provoking. It was mainly art and stuff that got you to think about it, rather than telling you what it is.” (Female visitor 1, aged 15 to 18)

“What I liked most about the exhibition is that it helps you to have ideas of your own, it doesn’t limit us to theories that are developed by other people.” (Female visitor 2, aged 15-18)

This also applied to students of other subjects. A medical student from King’s visited the exhibition three times, and was struck by the way the research was portrayed as an ongoing process of discovery rather than a factual reference to back up the medical processes she was being taught.

“Medicine is quite a bit clearer, but there are still things we don’t understand. The exhibition has opened my mind to that again. A lot of what we [medical students] are taught is facts but we aren’t able to discover things for ourselves” (Medical Student, female, aged 19 to 25.)

“The experimental aspect really hit me it was interesting to see how different researchers have found about it [dark matter] in different ways – different approaches mean different insights. It’s interesting to think about how you might even begin to discover something you know nothing about.” (Medical Student, female, aged 19 to 25 – as above)

The Science Gallery London Mediators themselves also found that DARK MATTER inspired them to research more, and showed them how contemporary art can generate conversations around contemporary science.

I found DM particularly interesting because it was an environment where it was useful to have more physics knowledge so I did more research – listening to podcasts et. The artworks were more contemporary modern art so it was useful for us to see the different ways that artworks can be presented and how those philosophical questions can be addressed (Lauren Angelkov Cummings, SGL’s lead Mediator)

For others with less of a relationship with Physics or science, the exhibition still allowed them to explore their own thoughts.

“I had loads of ideas in there – it’s reinforced the idea that the journey is more valuable than the end result”. (Music Journalist, aged 21)

Alongside our visitor surveys and interviews, we spoke to some young people who were more deeply engaged with Science Gallery London through their Young Leaders programme. This included a series of performance workshops which culminated in some dark matter inspired activities for visitors to Friday Late: Elemental on July 19th, and a film produced by a Young Leader in response to conversations with Season Advisor Malcolm Fairbairn. See the appendix for case studies with more detail.

You, Me and Everything In Between 10 young people met King’s researcher Miguel Campos who is part of Malcolm’s department. He explained the research and concepts around Dark Matter, and this provided a rich starting point for a creative project at Science Gallery London’s late event. Their experience of working with Miguel gave them the confidence to tackle this complex subject.

“I have always thought that dark matter seemed like a very complex subject, and it is, but it was also simple at the same time. I think that if I can tackle dark matter I should be able to tackle other subjects in science.” (Carlos, Mosaic workshop participant)

“Meeting a scientist expands the young people’s understanding of what is possible... I believe Miguel’s sharing of knowledge had a fundamental impact on the people and the process. His general demeanor was very relaxed. He was really passionate about dark matter and helping us understand it. A lot of his skill is as a communicator and that’s why we were all really inspired.” (Steph Singer, Bittersuite workshop facilitator)

DARK MATTER Film Following a conversation with Malcolm, Science Gallery Young Leader and Mediator Laura Joy Pieters collaborated with film maker Adeyemi Michael to produce a film which uses Dark Matter as a metaphor for the marginalisation of black women in society. This was screened on Chanel 4’s Random Acts platform in October 2019 and is available on youtube where it attracted 750 views in it’s first month.

<https://www.youtube.com/watch?v=mLSYZzVVPjY>

This project gave Laura an opportunity to achieve her ambition to produce a film, and to address her own experience as a woman of colour in science.

“On the mediator team there are a few of us – women of colour who work in science. I chatted to them about what the film could be and how rare it is to see women of colour in science especially physics” (Laura Pieters, SGL young leader and mediator)

When describing how the film used dark matter as a direct metaphor for this experience Laura explained:

“Dark Matter represented an unseen presence that’s all around us but not acknowledged. A sense of mystery that people are fearful of. We see its effects but don’t acknowledge it.” (Laura Pieters, SGL young leader and mediator, describing dark matter as a metaphor for women of colour in science)

Malcolm influenced the film in several ways. He was present at the initial meeting where Laura first pitched the idea, offered physics knowledge, and gave her the details of several young female physicists. The exhibition itself also influenced Laura, who described ‘the sense of unknown and wonder that the visitors gave.’

KEY LEARNING FOR SCIENCE GALLERY LONDON

“It was the most attended show ever, with 33 thousand people over the course of the season, and the lates were the most successful that we have run.” Jen Wong, SGL Head of Programming

DARK MATTER was the most successful exhibition to date, both in terms of visitor numbers and commercial profit, but this is not the extent of its impact on the organisation. Science Gallery London had not previously collaborated in such a sustained way with just one season advisor, so Malcolm Fairbairn’s involvement has given them experience of a new way of working, which will allow them to explore subjects more deeply and more effectively in future.

“It presented an opportunity that we hadn’t previously anticipated. We had previously seen that it was valuable to get advice at specific points of a project, but we hadn’t previously had a senior academic such as Malcolm working in parallel to a whole project from the first conversation through to being available at things like the press preview and being engaged as part of the project team all the way through. We hadn’t done that before. If that sort of opportunity presents itself again where we have an area of research where we want to go really quite deep where there isn’t good public understanding, this is the model that we would look to develop.” John O’Shea, SGL Associate Director

Associate Director John O’Shea described this new style of collaboration as “360 involvement” where the season advisor interacts with everyone from front of house to curatorial and the artists themselves, giving the organisation multiple opportunities to understand and communicate their research from multiple perspectives.

“It’s given us a 360 degree perspective on what Malcom’s research means – the more people who can ask questions from their perspective the more ways of looking at the topic emerge. For the public who visit the gallery and won’t necessarily meet Malcom, they can encounter the topic from these multiple perspectives through one researcher.” John O’Shea, SGL Associate Director

Building on knowledge became a theme for the Science Gallery London team as they developed and delivered the Dark matter exhibition. While previous exhibitions have allowed people to explore a subject in a self-directed way, DARK MATTER followed a linear narrative structure. Visitors entered to exhibits exploring ideas about the known world of physics and matter, and as they got deeper into the exhibition the ideas became broader and more abstract. This enabled visitors to gradually build up knowledge and understanding of the subject.

DARK MATTER also created an opportunity for Science Gallery London to test a new model for their team of Mediators, who were joined this season for the first time by four subject specific PHD and Physics students from King's. By working alongside each other the mediators and physicists were able to develop better ways to engage the public with the research while also developing each others skills in public engagement.

"There was a really useful interplay between the physics PHD and wider SGL mediator pool who come from a range of topics. This is something new that emerged from early conversations about wanting to go deep into a topic rather than going broad, which we would look to take onboard as a principle in future when we have another topic where we need to go deep." John O'Shea, SGL Associate Director

The mediators themselves found the presence of the subject specific students helpful when visitors asked questions they could not answer. They recognised that for exhibitions with in-depth or very specific content this would be a useful dynamic to repeat.

"It was on the whole positive because a lot of visitors don't know that its an art gallery and ask questions they might do at the Science Museum, so it was good to double check things with the students. Maybe visitors liked having a free physics lesson! (Laura Joy Pieters, SGL Mediator and young leader)

"If I didn't understand something I would then go and have a conversation with a Physics student to try and understand it better." (Lauren Angelkov Cummings, SGL's lead Mediator)

"Doing that exhibition made me realise that DM knowledge is actually quite niche. If we are going in to one very specific topic they [subject specific mediators] can be quite useful for that." (Lauren Angelkov Cummings, SGL's lead Mediator)

However they were careful to stress that non-subject specific Mediators with more general knowledge and public engagement expertise are equally important. DARK MATTER generated questions around Philosophy and art as well as physics which the different mediators could use to draw out different conversations.

"We also really need the general pool of mediators with variety and diversity of knowledge to make sure a range of visitors can engage." (Lauren Angelkov Cummings, SGL's lead Mediator)

A celebratory event organised by Public Engagement Manager Dr Jamie Dorey gave people from King's College London's faculty of Natural Science and Mathematics (NMS) an opportunity to experience the exhibition and hear how collaborations with Science Gallery London can support their public engagement work. This, alongside the close relationship forged with Malcolm Fairbairn has resulted in a stronger relationship between Science Gallery London and King's.

"Working with Malcolm enabled us to build closer links with NMS as a faculty because of the depth of his involvement" Jen Wong, SGL Head of Programming