# Technology and the arts: Past, present and future synergies

Technology and the arts are generally considered distinct sectors of contemporary society, albeit with some important links, akin to those between the commercial, industrial and legal sectors. However, technology and the arts have a long and special relationship that permeates all stages of human development. Indeed, this relationship is invoked with every mention of the word technology, which has its origins in the Ancient Greek *tékhnē*, meaning art.

From the first paintings to the production of musical instruments and contemporary cinema, art as we understand it today would simply be impossible without recourse to humanity's historical cache of technological development. Throughout history and modernity, technologies ranging from ink, paper and glass to cameras, microphones and computers have enabled new forms of art. Without them, it would be impossible to realise the paintings, ornaments, photography, cinema and contemporary digital works that fill our museums and galleries. Looking at art in this way invites a key question: How does technological development enable new dimensions of artistic endeavour?
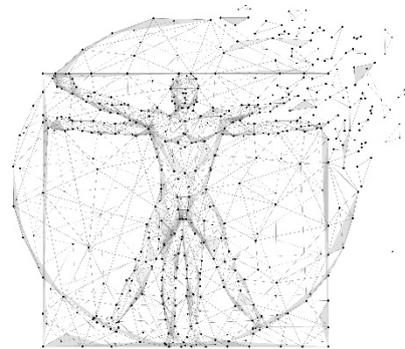
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The reverse of this relationship is also important, with the arts driving innovation and generating substantial demand for technology. In the course of their work, artists often develop new techniques and push the boundaries of the imagination in ways that can provoke new directions in technological development. Wider activities in the arts – from preserving and restoring ancient works to producing stunning visual graphics and immersive environments – also generate substantial demand for innovation. Demand for technology is also evident in the consumption of art, notably through audiovisual equipment and content. Looking at technology in this way invites a second key question: How do artistic endeavours enable new dimensions of technological development?

The two questions reveal different aspects of the same deep synergetic relationship between technology and the arts. They support each other, and the outcomes are valuable for artists and technologists while also providing wider social, cultural and economic benefits. This invites a third key question: How can the synergetic relationship between technology and the arts be optimised to maximise its benefits?

In this context, STOA launched a study of these questions addressing the past, present and future of the synergetic relationship between technology and the arts. The first study, conducted by Artshare, reviews historical developments from cave paintings to photography, while the second, conducted by Nesta, focuses on the digital era.

Future trends

The Nesta study included a review of trends connected to technology and the arts that could become more pronounced in future. While these are not certain, they are intuitively reasonable and

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serve to underline the growing importance of understanding the synergies between technology and the arts. Trends identified include:

- Greater demand for products and services that combine artistic and technical skills in a wider range of domains, as well as greater capacity of companies to deliver them.
- Breakthroughs in the application of virtual and augmented reality creating new platforms for artistic expression.
- Growing pervasiveness of games and gaming platforms, making links between creative activities and other fields, such as artificial intelligence and machine learning.
- More accessible digital tools, and more people using them for creative purposes in a wide range of contexts.
- Greater collaboration, driven by the need for a wider range of highly specialist skills from across the increasingly broad technology-arts sector in order to deliver more ambitious projects.
- Increased pervasiveness of artificial intelligence in the creative sector as recommendation systems are used more often, and become more accurate and influential.
- The emergence of 'creative artificial intelligence' which produces content for mass consumption or even generating personalised content for individuals in real time.
- Greater collective participation in artistic projects, blurring the boundaries between producers and consumers.
- Increasing role of data, as a pervasive internet of things diminishes the boundary between physical and analogue spaces.

Policy options

This section sets out several options for policies that could optimise the art-technology relationship and maximise its beneficial outcomes, drawing on and developing those suggested in the studies.

1. Promote all forms of artistic and technological innovation independently

Given the deep synergies between technology and the arts, development in either sector tends to lead to benefits for the other. As such, the first category of policy options is simply to support artistic and technological development activities independently, and trust that connections will result from the strength of their mutually beneficial relationship.

- Promoting all kinds of artistic activity – by funding artists to explore ideas and concepts within and beyond the cultural sector – can stimulate technological innovation in the same ways that artistic activities always have. This includes developing new technologies and applications and fostering demand for artefacts. Artistic activities could also create wider cultural value related to technology, for example in helping society to make sense of humanity in the digital era.
- Promoting all kinds of technological innovation can also stimulate artistic and creative activities, sometimes in surprising ways. Artificial intelligence, for example, has several important links with both the production and consumption of art, from tools that recommend creative content that consumers may appreciate, to the autonomous machine generation of sound and images. Another good example is 3D printing, offering a new medium for creativity that may be more accessible to individuals with less technical capabilities or fewer financial resources.

2. Promote artistic activities in technology domains, and technology use in artistic activities

The second category of options is to support some crossover between the sectors. This could include stimulating artistic activities within technology domains, which could help add social and cultural value to innovation processes and enable them to pursue broader or more ambitious goals. On the other hand, it could involve stimulating the use and development of innovative technologies as part of the artistic process, which could help artists to make greater use of

technological capabilities and lead to more interesting applications of innovation, as well as more innovative forms of art.

- Promoting artist residencies within technology research centres could add value to innovation processes and allow parallel exploration of other avenues, through the addition of artist-led sub-objectives.
- Encouraging technology developers to participate actively in artistic activities from the early stages of projects could help artists to make more effective use of technologies and push the boundaries further than might otherwise be possible.
- Establishing prizes for art that makes use of innovative technologies could provide a greater incentive for artists to make use of technologies in their work. Such pieces tend to be comparatively expensive and are considered to have a smaller market. The aims of the prize could be refined, for example to focus on supporting pan-European collaboration, early-career practitioners or wider visibility for these kinds of projects. Depending on the aims, the programme could provide mechanisms for accessing resources such as equipment, expertise and communications channels, as well as finances.
- Adjusting the definition of research and development to embrace research and development within the arts sector could enable more artistic activities – particularly those that make innovative use of advanced technologies – to access the funding and support mechanisms that already exist. This could mean extending the definition to embrace knowledge creation and project outcomes related to experiences.

3. Develop understanding of and appreciation for synergies between technology and the arts

The third set of options focus on enhancing our recognition of the synergetic relationship between technology and the arts, in particular to fill gaps in our understanding of those activities that do not neatly fit into either category.

- Data science techniques, such as machine learning, can be applied alongside more traditional methods, such as surveys and interviews, to analyse how ecosystems of digital creative activities emerge. The Nesta report showed how European success stories tend to emerge from cities that perform well in the European Digital Cities Index. By understanding these correlations and exploring the conditions that foster success, lessons can be learnt that might be transferable to other locations.
- Job roles at the art-technology interface are not always captured in industrial analyses, which can struggle to capture the importance of fast-changing sectors that do not neatly fit into one category. Initiatives could be launched to explore the full extent of the industry that straddles these sectors, allowing a better-informed reflection on the job market as well as other key indices and future projections. This knowledge can inform the development of strategic policies to support art and technology effectively, and provide evidence to justify the implementation of further programmes.

4. Promote collaboration between engineers and artists

Of course, policies can directly promote collaborations between artists and technology developers, as equal partners, with the aim of stimulating synergies.

- One approach could be to create groups that include technology developers and artists, and deploying them to design and implement projects that respond to real-world challenges. The challenges could have socio-cultural, infrastructural or environmental aspects, such as the organisation of specific communities or activities in rural and urban contexts.
- While collaboration may be considered the norm for larger technology projects, as well as major commercial activities from the cultural sector, such as filmmaking and game design, the stereotype of the lone artist and inventor persists in popular imagination as well as some

funding models. Developing funding programmes that recognise the role of cross-sectoral collaboration could help bring together actors with complementary specialist skills.

- While digital technologies can make it easier to overcome geographical distances and collaborate with a wider range of actors, some spaces and activities have less access to the required tools and expertise. Programmes could focus on overcoming these digital divides, but also on ensuring that initiatives are not exclusively digital and include actors that, for whatever reason, tend to work offline.

5. Promote skills development that spans art and technology

Finally, policies could promote skills development that capitalises on synergies to develop the next generation of innovators in technology, the arts and beyond.

- While technology and art are often separate parts of school curriculums and university structures, creating spaces where they are combined at all levels of the education system could help students to develop interdisciplinary skills and enable them to work more effectively with people from other disciplines.
- Developing skills and experience in using open source technologies – which are distributed and can be modified by any individual – could support individuals in later specialisations in technology and the arts. Open source makes powerful tools more accessible in terms of both financial resources and expertise, and often attract supportive knowledge-sharing communities, which can offer encouragement, advice and even collaborative partners that can help people to realise projects.
- While software and hardware are both increasingly accessible, artists working at the cutting edge of technological innovation need advanced skills to work effectively. Promoting artists to develop these skills could not only help them to realise their own projects, but could also contribute to even more accessible interfaces for the next generation of digital tools. Programmes could target all stages of creative careers, starting with all levels of digital literacy.
- The role of technology in art is sometimes self-evident, for example in the case of immersive digital environments. In other cases, it is less clear and can easily be overlooked by the audience. Many young minds inspired by graphics in films, for example, may not appreciate the range of technical and scientific skills that are required to achieve them. Education programmes could deliberately blend art and technology in ways that support students to understand the range of skills that are involved, perhaps, to identify specialist roles of which they might otherwise not have been aware.