**Polymathic pedagogies: creating the conditions for interdisciplinary enquiry in art and science**

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**Illustrations**

Image 1: Art and science experiments in the studio - enacting parts of the brain. A participatory experiment by Joshua Bourke. Photo © MA Art and Science.

Image 2: Lists of Matter / Method / Material creating randomly selected project briefs. Photo © MA Art and Science.

Image 3: ‘Objective drawing devices’ being tested with a life model in the studio, alongside some of the drawings produced by the devices. Photo © MA Art and Science.

Image 4: *Fields* degree show 2018, foreground work by Áinne Burke. Photo © MA Art and Science.

Image 5: Speculative objects created for the *Museum of Extraordinary Objects 2035.* Photo © MA Art and Science.

**Abstract:**

The MA Art and Science, Central Saint Martins (University of the Arts London) was established in 2011 for students wishing to undertake a Masters Degree at the intersection of these fields, within a fine art programme. Under a course philosophy of openness to multi- and interdisciplinary research, curriculum evolution has been driven by the interdisciplinary faculty, students and external partners. Great student diversity in disciplines, cultures and ages, plus challenges of working at the intersection of huge disciplines, have necessitated development of particular educational approaches, 'polymathic pedagogies', untypical of fine art courses. Chief among these are: strategies for developing individualised hybrid research and creative methods challenging disciplinary norms; a strong focus on enquiry and experimentation; and opportunities to collaborate with external partners including cultural organisations, community groups, research laboratories and scientific institutions. Although some common 'content' is presented via lectures, seminars and visits, the course is non-dogmatic and anti-canonical, facilitating individualised and collective learning. Thinking through making, learning through 'play', and methods employing chance maximise criticality and creativity, and build confidence. Success of the course, subsequently joined by others worldwide, demonstrates that novel 'polymathic pedagogies' can be successfully developed and applied within interdisciplinary art and science education at Masters level.

**Keywords:** art and science; art and design; postgraduate education; higher education; interdisciplinary education; curriculum design; emergent curriculum; polymathic pedagogy;

**Introduction**

'Where our age falls short is in the harmonizing of our outer and our inner wealth. We lack the depth of feeling and the range of sensibility needed to retain the riches that science and technique have brought within our grasp. The images and symbols which can truly domesticate the newly revealed aspects of nature will be developed only if we use all our faculties to the full – assimilate with the scientist’s brain, the poet’s heart, the painter’s eyes.'

(Gyorgy Kepes 1963 [1956]: 20)

It is necessary, suggested artist and educator Gyorgy Kepes[[1]](#footnote-1), to bring together the intellectual and sensorial qualities of different disciplines in order to humanise the world that science and technology reveal to us. In the half-century since he wrote this passage, the challenges faced by humanity have become increasingly apparent. Indeed, the risks of a profound alienation from the world revealed by science and technology are today posed in the most acute manner by the accelerating environmental crisis. Coupled with the rapid advances in informatics, robotics and nanotechnology, deep questions are raised about what 'we' are as humans, let alone what we desire, and where we might be heading.

Historically, we may trace an apparent division between the arts and the sciences, in the 'West' at least, to the 'scientific revolution' of the sixteenth century. Earlier, in the time of Leonardo da Vinci (1452-1519), the division between 'art' and 'science' barely existed in the way we understand it today. The Latin terms for art and science - ‘*ars’* and ‘*scientia’* referred respectively to ‘skill’ and ‘knowledge’, which could be harmoniously combined in any enterprise (Ackerman 1969). The ‘scientific’ activity (then termed 'natural philosophy') of Renaissance artists such as Leonardo da Vinci or Albrecht Dürer - anatomy, landscapes, nature studies - could be seen as entirely consistent with their ‘artistic’ endeavours, since both served 'naturalism' and the representation (‘re-presentation’) of ‘nature’ in art[[2]](#footnote-2).

The development of instrumentation in the sixteenth century's scientific revolution extended human senses far beyond our normal direct experience. The invention of tools, such as the microscope and the telescope, thus introduced a mediating layer between human sensory experience and the 'natural' world, although this world newly revealed by science could still be pictured (see for example Robert Hooke's engravings of the head of a drone fly or of a flea in *Micrographia* 1665). At the same time, disciplines such as physics began to be concerned more with theoretical questions concerning invisible forces not accessible to direct experience. As science shifted in some respects away from direct sensory experience, 'art' remained focused upon sensual 'human' experience. Perhaps most critical to the growing division of 'art' and 'science' was the increasing adoption of mathematics within science, with an emphasis upon repeatability of experiments producing ‘data’ (Francis Bacon (*Novum Organum*) (2015 [1620]). Marshall McLuhan put it succinctly:

…with regard to the sixteenth century, number and visuality, or tactility and retinal experience, split quite asunder and went their divergent ways to set up the rival empires of Art and Science.

(McLuhan 1962: 81)

By the eighteenth century Enlightenment this division of art and science was further accentuated, as the precision of mathematics and words became the preferred language of serious discourse. Images became less important to much of science, and ‘art’ tended to be relegated to concerns with beauty or the sublime.[[3]](#footnote-3) (W.J.T. Mitchell 1987).

The separation of arts (and humanities) from science has also been reflected in the organisation of education, leading to what CP Snow described in 1959 as 'the two cultures' – artists and scientists, whose education[[4]](#footnote-4), career and subsequent cultural life led them to lack mutual understanding of each other or of their wider disciplines (Snow 2006). Snow favoured a more broadly based education system than that which then prevailed in Britain, which he described as producing a 'tiny elite… educated in one academic skill' (Snow 2006: 19).

Nevertheless, a number of pioneering initiatives in education in the twentieth and twenty-first centuries have attempted to bring together art and science education and research at graduate and postgraduate level. Notable are the Bauhaus (1919-1933) (Whitford 2010); The Center for Advanced Visual Studies at MIT[[5]](#footnote-5) (1967-2009) founded by Gyorgy Kepes (ACT 2018); and Black Mountain College (1933-1957) (Nichols 2015).

In this chapter we present a case study of the approach taken by the MA Art and Science, Central Saint Martins (University of the Arts London[[6]](#footnote-6)), which addresses interdisciplinary connections of art and science within the context of a 'fine art' Masters programme in an arts university. In expounding this case study we discuss some of the teaching philosophies and methods developed for this purpose, and define the 'polymathic pedagogies'[[7]](#footnote-7) that we believe would satisfy Kepes’s aspiration of retaining the riches that combined sensibilities can bring.

**Art and science interdisciplinary education: the MA Art and Science, Central Saint Martins, University of the Arts London**

The Masters course in Art and Science, at Central Saint Martins (CSM), was established in 2011 by Nathan Cohen to provide a distinctive postgraduate educational programme for those interested in studying art and science as an interdiscipline[[8]](#footnote-8) within a studio context – something not available elsewhere at that time. The University of the Arts London, of which CSM is a constituent college, had never previously included science in its educational portfolio, and so the first task was to persuade the University of the rationale, quality and viability of bringing the two disciplines together, which represented a radical step for the institution.

Today, the two-year full time MA Art and Science recruits around 20 students per year, with almost 120 alumni having graduated. The faculty of the MA have developed particular pedagogic practices in the facilitation of interdisciplinary art and science enquiry within a Fine Art context[[9]](#footnote-9), and within the wider environment of an art and design university. Pedagogic challenges - and opportunities - include the great diversity of students, who come from many disciplinary backgrounds: including science, medicine, fine art, design, social science and humanities. Students are diverse in national culture, with around two thirds from the UK and EU and one third from other parts of the world. Furthermore, students are diverse in age, ranging from first Degree graduates to those of all ages who have work and life experience. To date, some three quarters of the cohort are female – which is in line with the preponderance of female students in UK Fine Art higher education (HESA 2018).

**Course aims and philosophy**

Under the framework of a fine art programme – namely, a studio based course of largely self-defined project research and practice supported by the taught curriculum and faculty supervision – the MA aims to explore the changing nature of creative scholarship, applying hybrid modes of enquiry to art and science discourse. The requirements to complete the Masters Degree include an integration of research and practice, in written and created form. Some aspects of the course are conventional within a UK-based arts education, such as studio-based teaching, tutorials, discursive seminars and 'crits'[[10]](#footnote-10) (critical reviews) of work in progress. But other aspects are more unusual in this setting.

The challenges of teaching widely diverse students, and of tackling the intersections of two extremely broad fields of study, have resulted in the development of particular polymathic pedagogies, which include:

* set experimental project briefs (common in design education but unusual for fine art);
* a general encouragement of collaboration – among students, and with other individuals, institutions and courses;
* an anti-canonical approach, questioning established definitions;
* processes of 'unlearning' and methods of chance and play;
* student-centred and experiential learning.

Since its creation the course has developed through the experience and expertise of the faculty and a diverse group of students, each bringing a unique combination of knowledge, skills and questions to investigate. What they share is a recognition that there are multiple ways of asking questions and seeking understanding, and a notion that they sit somewhere in-between, or across, established domains. The course faculty aim to provide a space for dialogue and interaction between disciplinary knowledge and methods, without *a priori* notions of where this might lead or of what might result. The collaborative focus of the course helps in the creation of 'communities of practice' (Wenger 2008) within the cohort and in relation to wider networks, in association with alumni and other practitioners in the field. These communities have the potential to enhance students' research and practice whilst studying and to contribute to their professional life after graduation.

The course faculty comprise artists and educators who have experience of studying science and/or working with scientists as part of their professional practice. This combination offers mentorship based on personal experience that students can relate to and learn from and is complemented by a growing network of contributors from both the sciences and the arts who enhance the cultural and pedagogic experience[[11]](#footnote-11). The emphasis upon student-centred learning, rather than didactic delivery, and the anti-canonical approach arise in part from a course philosophy that is open to challenge and non-dogmatic about what constitutes ‘art and science’. Whether we define this emerging field as an ‘interdiscipline’ or as an ‘adiscipline’ is up for continuous debate and the course invites each student to form their own connections, identify points of divergence and find synergies.

Much of the activity that takes place within the studio, both in teaching and in the creative practice, might be encountered in any shared artistic studio. Yet the space also operates as a kind of 'laboratory', an experimental space where students can engage in dialogue and exchange. Here, students can coalesce diverse expertise and can learn from their interactions with each other. For example, in Image 1 we can see students enacting different parts of the brain in a student-devised participatory experiment to explore synaptic communication. The physical proximity provided by the shared studio encourages the cross-fertilisation of ideas, skills and, most importantly, of possibilities. In the pursuit of new ways of thinking and novel forms of interaction, exposure to difference is a key driving mechanism for discovery. Methods of working employed by students combine conventional artistic practices – such as drawing, painting, sculpture, installation, and performance – with materials and processes drawn from the sciences - such as biology, complex systems, mathematical principles[[12]](#footnote-12), electronics, chemistry, or physics.

Image 1: Art and science experiments in the studio - enacting parts of the brain. A participatory experiment by Joshua Bourke. Photo © MA Art and Science.

The course is an evolving programme, responsive to the individual interests of students and the wider influence of external factors such as the social, philosophical and ethical questions raised by contemporary techno-scientific developments. Students are encouraged to explore new and innovative ways of perceiving, interrogating and understanding the world. There are no theoretical limits to the concepts, materials and techniques that can be worked with, and the course is open to a broad spectrum of research proposals. Throughout their time on the MA, students, and those who teach them, are continuously contributing new definitions and interpretations of what the subject of ‘art and science’ is and what it might become.

**Experimental practices and polymathic pedagogies: or 'can interdisciplinarity be taught?'**

In present-day cultural terms the enemy is habit – the passive, uncritical repetition or acceptance of behaviours, opinions, perceptions, and values, and the enshrining as verities, metaphors that have passed their sell-by date. Habit is the enemy of art, impeding the search for new ways of being.

(Ascott 2008: 48)

To understand what this looks like in practice, we now examine specific examples from the curriculum, while considering the polymathic pedagogic practices that take place at different points throughout the course timeline. These take the students through a two-year process of deconstruction, recombination and realisation.

It is a challenge to devise a curriculum for such a diverse group of students, who arrive on the course not only with wide ranging disciplinary knowledge but also varied pedagogic histories. Those with prior educational experience more geared towards the arts are likely to have more confidence with material exploration and self-directed project ideation, while those who have predominantly studied sciences may be stronger on academic research methods and project management. Students from one background may find intimidating, or may idealise, the perceived expertise of those from a different background. Considered along with the international constituency of the cohort and wide range of educational experiences (and expectations about how to learn) it is important to begin each year by recognising and valuing difference.

Following our starting gambit of declaring that all established definitions are mutable and open to questioning we dedicate the first few months of the course to a process of ‘unlearning’. This involves challenging established disciplinary norms and exploding preconceptions, thereby recognising the importance of diverse practices and making chosen methods more explicitly understood rather than implicitly accepted. We also aim to challenge perceived hierarchies of methods by elevating material, visual and sensorial modes of enquiry alongside more conventional academic approaches. Whether driven by concepts, materials or processes all methods are considered valid. In practice this is explored through an experimental project focused on combining approaches to interdisciplinary project development.

**‘Matter | Method | Material'**

Matter Method Material helped me remember forgotten creative skills: how to make the first mark, how to successfully brainstorm an idea, and how to look objectively at the results… [Take Me, I Will Shelter You] is an experiment in metaphor concerned with climate change in Britain, specifically: rising sea levels, flooding, and human migration.

**(**Hannah Scott, class of 2017,responds to ‘Travel | Installation | Video’, 2015)

‘Matter | Method | Material'[[13]](#footnote-13) is an exploratory exercise designed to challenge disciplinary habits, open up possibilities for novel approaches, develop creative strategies, and to encourage students to formulate hybrid modes of working. Working in small groups students generate lists under the headings of ‘subject matter’, ‘methods of working’ and ‘materials’. Three randomly selected items (one from each category chosen by the roll of a die) then form a project brief for each participant (Image 2). With a focus on process rather than product, this creative experiment encourages the testing of ideas in practice and identifying novel connections between the three given elements. By thinking through doing, and by combining concepts, processes and materials, students are encouraged to embrace risk and the serendipity of chance.

Image 2: Lists of Matter / Method / Material creating randomly selected project briefs. Photo © MA Art and Science

Students are given three weeks to experiment with these forced connections, followed by a student led critical review which sets out to discuss what has been learnt from the process, identify challenges and opportunities that emerge, and explore what might be taken forward into future project work. Students have reported that the project required them to work in radically different ways and took them out of their 'comfort zone'; and that it encouraged them to work with new materials and unusual processes, responding to and interpreting the given themes and subjects.

The *Matter | Method | Material* experiment is designed to acknowledge (and not privilege) different possible starting points to ideation – i.e. conceptual, material, or process-orientated – and makes explicit that there are many different, equally valid, approaches to creative enquiry. This imparts confidence in making by having to think through doing, encourages research to underpin knowledge of a given subject area, and playfully teases out a myriad of possibilities to generate ideas and communicate concepts.

Working on given themes, and being told explicitly not to be concerned with outcomes, also encourages a freedom of approach. As the brief does not necessarily relate to the project themes that students came onto the course to pursue, they have little or no sense of responsibility towards them, resulting in far greater risk-taking – the randomly-set parameters necessitating creative experimentation and invention. Becoming aware of this is important. By developing creative strategies away from their chosen fields of enquiry, methods can now be developed and applied to themes to which they are committed, only now with a more open and exploratory approach. The aim is that creative strategies developed through this short set exercise can migrate to self-directed project work throughout the course, helping students to approach material, practical and conceptual unknowns confidently, armed with a toolkit of possibilities[[14]](#footnote-14).

Throughout the early part of the MA Art and Science course the faculty expose students to different methods of critical and creative investigation of diverse histories, theories and practices. We examine the origins of the scientific method, explore practice as research, interrogate ideas of empirical experimentation, and play with chance. Lectures and seminars introduce key concepts that are then explored in discussion and through practical experimentation. Examples of the application of ideas into playful exploration include the introduction to a straightforward method of criticism[[15]](#footnote-15) through object interrogation and curation followed by further application and discussion of the method; investigation of subjectivity and representation through the making and testing of an (often absurd) ‘objective drawing device’[[16]](#footnote-16) (Image 3); and an exercise mapping key moments in the history of art, science, technology and ideas through the collective compilation of a timeline[[17]](#footnote-17).

Image 3: ‘Objective drawing devices’ being tested with a life model in the studio, alongside some of the drawings produced by the devices. Photo © MA Art and Science.

By introducing a range of approaches to project development, ways of working and thinking are made explicit and expanded. These early experimental polymathic approaches are intended to provide students with a bespoke tool kit of interdisciplinary methods for practice-based research. As they progress through the course, students’ work becomes increasingly self-directed (though, as we explain further below, it may well be collaborative). Supported by faculty and peers, students forge their own paths, accessing resources and expertise, developing skills and knowledge, and formulating unique combinatory methods.

Each student pursues a major independent project throughout their two years on the course, resulting in a public showing of the realised outcomes. The degree show is a well-established finale within art and design education, an opportunity to present the results of human endeavour and showcase talents. For the MA Art and Science the form and function of this graduation show is always open to debate. Each year we invite the students to define the character of the exhibition, to suit their individual and collective aspirations. The degree show has, over the years, provided a platform for exhibition, demonstration, participation, discussion, experimentation, and performance (Image 4) – with students encouraged to be present in the space and to engage with the audience. Students also curate a symposium and events programme that complements the exhibition, in which student performances have also become a significant aspect. Although the MA Art and Science embeds professional development in the curriculum throughout the course, the degree show represents a further transition into the professional realm, a springboard for what happens next.

Image 4: *Fields* degree show 2018, foreground work by Áinne Burke. Photo © MA Art and Science.

**Professional platforms and collaborative learning**

My experience of studying Art and Science will influence my future research practices, as I am now aware of various platforms and open to collaborating as well as confident enough to ask to collaborate with others; which is something I was not able to do so before, having come from a purely Fine Arts background. The slight variation in studio setting in Art and Science has broadened my idea of where I can work, who I can work with, and what I can make there; such as labs, offices, co-working spaces, project spaces and of course, what I know best, a studio with a blocked sink.

(Sabrina Mumtaz Hasan, class of 2019)

As students pursue their independent projects within the course structure they are encouraged to develop collaborative approaches to their research with a view to forging interdisciplinary relationships and, by the time of graduation, building a strong professional network. The course supports this endeavour through individual mentorship by staff and by offering a number of opportunities to engage in external course-initiated collaborations. Since the course began in 2011 students have had opportunities to work with a number of partners and collaborators on a range of projects including residencies, educational workshops and exploratory exchanges[[18]](#footnote-18). These include scientific institutions such as CERN, Imperial College London, the Medical Research Council, and cultural organisations such as Tate Exchange, Arts Catalyst, and the British Library.

These (optional and self-selecting) projects facilitate professional engagement with experts from different fields across the sciences, design, education and the arts. They enable students to develop context-specific collaborative skills, and help build networks for exchange providing the potential for continued research. The interdisciplinary skills enhanced through this process include the ability to navigate different languages, cultures, environments, intentions and outcomes – to traverse disciplinary differences in the pursuit of shared goals.

***The Museum of Extraordinary Objects***

One beauty of the collaboration was that in explaining the issues to the artists, the Royal Society themselves made real progress in clarifying their thinking about the themes that they wanted to interrogate.

(Julie Light, class of 2018)

To examine one such collaboration we draw here on a project developed with The Royal Society, *'The Museum of Extraordinary Objects*', a collection of fictional objects created by students on the MA Art and Science speculating on the future of scientific research. Led by students Stephen Bennett and Julie Light, the project demonstrated how diverse perspectives can reveal deep insights into complex research questions.

The Royal Society, established in 1660, is the world's oldest independent scientific academy (Royal Society 2019a), with early members including Christopher Wren, Robert Boyle and Isaac Newton. Recently the Society has expanded its focus on the role of culture, expectations and relationships in determining the future of scientific research. In particular, a 2016 project entitled *Changing Expectations* aimed to 'understand how best to steward research culture through a shifting research landscape' (Royal Society 2019b). The project recognised that the hidden signs, rules and expectations of the science community would fundamentally determine what kind of research was undertaken in the future; by whom, for whom, and with what results.

Initial events, organised by the Royal Society to explore these questions with early-career researchers, demonstrated some limitations of traditional ‘workshop’ approaches. Young scientists tended to reflect on day-to-day issues they faced, such as job security, stress, and navigating academic hierarchies. Although important, such topics were not helpful to the imagining of a future research culture. This challenge was presented to the interdisciplinary students of the MA Art and Science.

The team of students who participated in the project facilitated a different kind of conversation by translating the elements of potential future research cultures into materialised artefacts. An imagined future museum of objects presented a different set of future possibilities. One student artist proposed a memorial to a failed mission to Mars, an idea that stimulated an animated discussion around the culture of failure in scientific research. Another developed a provocation on the democratisation of research to those outside the traditional science community – a ‘Lab Cab’ to enable the transportation of live tissue from hospitals to hackspaces and home laboratories (Image 5). The speculative propositions were made and curated into a futuristic entity *The Museum of Extraordinary Objects 2035,* complete with its own history and catalogue (Royal Society 2019c).

Image 5: Speculative objects created for the *Museum of Extraordinary Objects 2035.* Photo © MA Art and Science.

The fictional ‘Museum’ toured the UK, shown in over a dozen locations to hundreds of scientists, the artefacts taking on a life of their own. Following their initial role in helping the Society develop its’ thinking, the objects became the stimulus for further discussion and analysis. Scientists considered what it would mean to have a roulette-like wheel determine interdisciplinary collaboration or contemplated the concept of a public ballot for funding research. In each case the artefacts embodied a complex and abstract concept (‘open access’, ‘citizen science’) and invited a haptic exploration by people accustomed to thinking more in equations and prose. When it was easier to talk about the present, they prised open discussion about the future, revealing deep, rich and diverse insights on potential futures of scientific research. Whilst the Royal Society's motto *'Nullius In Verba*' (taken to mean 'take nobody's word for it') supports the verification ‘of all statements by an appeal to facts determined by experiment’ (Royal Society 2019a), *The Museum of Extraordinary Objects 2035* demonstrated the value of engaging with imaginative narratives as a vehicle for serious speculative debate.

This projectis one of many examples of collaborations fostered by the course, as organisations increasingly recognise the possibilities and benefits of working in a space where multiple intelligences (Gardner 1999) can merge. During their studies, students will have been presented with numerous professional opportunities at course level as well as wider opportunities offered through the art programme, the college and the university. Thus, in addition to nurturing individual interdisciplinary practice, the MA Art and Science course is decidedly outward facing, connecting students with research groups, community organisations and public audiences.

Learning how to navigate this in-between space – between art and science, between student and professional – provides a valuable lesson in developing research methods, forms of language, and means of communication. In addition to working on course-led collaborations many students also choose to engage with external residency programmes (such as *Lumen*[[19]](#footnote-19), and *Labverde*[[20]](#footnote-20)), apply to open call exhibition opportunities[[21]](#footnote-21), publish artworks and writings in online magazines (such as *Interalia, CLOT* and *SciArt Magazine*), and curate independent exhibitions. Through following a self-directed line of enquiry and responding to opportunities offered, students build up substantial artistic and professional experience over the duration of the course and can graduate with a strong established network.

**Conclusion: Into the future**

Studying art and science has brought home the point that everything is connected, relational, and art is a key that unlocks a door to new ways of understanding. This greater awareness of my practice within the context of art and science led me to understand that by stepping outside my comfort zone and into unfamiliar or unknown territory, I also step into a position where I can embrace risk while indulging in childlike wonder – and these are the things that feed creativity and push work to new levels.

(Jill Mueller, class of 2018)

The MA Art and Science, Central Saint Martins (University of the Arts London), provides an intellectual and creative space that had not previously been catered for academically, for those wishing to engage in research at the intersection of art and science. The course is continuously evolving as a springboard for investigation, experimentation and discourse, building an emerging network of curious individuals seeking to investigate this area and contribute to its interpretation. Communities of practice and professional networks have become evident through continued graduate and student activity, and support the pedagogic rationale of the course.

The unusual features of the MA Art and Science approach to teaching – the polymathic pedagogies – are rooted in a course philosophy of openness to ideas and influences, and address the particular practical challenges and opportunities presented by the interdiscipline. These include the great diversity of students and the challenge of learning and teaching at the intersection of two wide fields of human learning – art and science. The process of 'unlearning' in the early stages of the programme leads to a 'reassembly' through individual and collaborative lines of enquiry. At all stages of the course students are encouraged to explore their interests experimentally and creatively while maintaining the curiosity that encouraged them to embark on their journey of enquiry. The emphasis upon chance methods and play is important in keeping a certain ‘lightness of touch’ and creative openness to exploration.

The MA Art and Science questions the relationships *between* disciplinary knowledges and practices, with an emphasis on the ‘AND’ in Art and Science. We are not seeking to create a canon. Rather, we celebrate the diversity of ideas and approaches that flourish when fixed interpretations are eschewed. We aim to create a platform for students to investigate and find their own definitions and points of reference. Individual empowerment within the context of an educational and wider societal community results in diverse interpretations of how different disciplinary knowledge and methods can interact, connect and collide.

The MA Art and Science contributes to a culture of enquiry and learning; it offers an education through an emergent lens (Barnett 2013, Mason), creating the conditions for collective knowledge building and sharing. The course seeks to reintegrate science into the humanities and to employ artistic research as a means of critically examining the implications of contemporary scientific research. Above all, it seeks to create a space where the breadth of human curiosity can flourish, and where different forms of knowing and creating can merge and forge novel insights and interpretations.

Our graduates continue in this endeavour through diverse lines of professional practice. Many alumni go on to develop interdisciplinary practices, setting up collectives, conducting residencies and exhibiting. Some progress their studies at doctoral level, develop a teaching practice or apply their interdisciplinary education to other areas of arts, design, curation, publishing, and museum work. Some return to scientific domains, though perhaps with a changed attitude towards established methodologies.

In recent years other interdisciplinary courses connecting aspects of art and science enquiry have emerged internationally, further validating the subject as a legitimate field of research. Within our own institution, Central Saint Martins, there is now far greater recognition of the value of interdisciplinary educational practices and acknowledgement that science is an integral part of society and culture. At the time of writing we are embarking on exciting new interdisciplinary ventures, including the opening of the 'GrowLab', a laboratory for biology and imaging, providing a safe space for students to work with living systems, learn laboratory practices and develop novel methodologies. Having our own scientific facilities within the art school will enable us to offer a bespoke hybrid laboratory/studio space[[22]](#footnote-22) encouraging exploration of bioart and biodesign practices in the wider context of art and science as an interdiscipline. The GrowLab offers new possibilities for polymathic pedagogies to emerge, allowing us to programme activities previously unavailable within a specialist art and design institution. In addition to supporting curriculum delivery on MA Art and Science, the GrowLab enables the expansion of research in this field and offer opportunities for doctoral students, visiting researchers and scientists in residence[[23]](#footnote-23). Through these and other initiatives, our institution now has a far greater understanding of how the languages and cultures of art and science can intersect and has shown significant commitment to developing educational and research provision in this growing area[[24]](#footnote-24).

In this chapter we show, through the examples presented, that novel 'polymathic pedagogies' – that facilitate the assimilation of diverse intellectual and sensorial modes of enquiry – can be developed and successfully applied to the teaching of an interdisciplinary Masters in Art and Science. We will continue to create the conditions for future cohorts to expand the field – each year bringing together a new group of self-defined creative interdisciplinarians to share diverse expertise and nurture new points of connection. It will ultimately be for others to judge the success, but we believe that the importance of such interdisciplinary approaches, as Kepes argues, extends far beyond the boundaries of art education, to touch wider, and urgent, cultural, social and political concerns.

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1. Gyorgy Kepes (1906-2001) founded the Center for Advanced Visual Studies (CAVS) at MIT in 1967 (ACT 2018). He edited an impressive series of art and science books in the 1950s and 1960s beginning in 1956 with *The new landscape in art and science*. [↑](#footnote-ref-1)
2. The representation of nature in art developed in the Renaissance in concert with the new theories of geometric fixed point perspective developed by architects Alberti (1404-1472) and Brunelleschi (1377-1446). For more on this see Panofsky, E. (1991) *Perspective as symbolic form.* New York: Zone Books.. [↑](#footnote-ref-2)
3. There are of course exceptions to this general trend, many from the field of ‘illustration’. Life sciences such as botany or entomology have continued to be based in observation and image making. In art, the painter Joseph Wright of Derby (1734-1797) is one notable practitioner who provided a critique of scientific and technological progress through his paintings. Similarly, in literature, Mary Shelley’s *Frankenstein: or the modern Prometheus* (2003 [1818]) is a work of enduring relevance in its critique of science and technology. [↑](#footnote-ref-3)
4. Snow was writing particularly about Britain and North America. [↑](#footnote-ref-4)
5. Now part of the MIT Visual Arts Program [↑](#footnote-ref-5)
6. Central Saint Martins is part of University of the Arts London, an international centre for innovative teaching and research in arts, design, fashion, communication and the performing arts. See: <https://www.arts.ac.uk/colleges/central-saint-martins> [↑](#footnote-ref-6)
7. Polymathic may be defined as 'characterized by varied learning' (Polymath 1984) [↑](#footnote-ref-7)
8. '…interdisciplinary studies may be defined as a process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession' (Newell and Klein, quoted in Fuchsman 2009: 71) [↑](#footnote-ref-8)
9. The course sits within a cluster of postgraduate art courses including MA Fine Art, MA Photography: Philosophy and the Contemporary Image, several MRes courses and BA Fine Art. [↑](#footnote-ref-9)
10. The 'crit' is typically a participatory studio-based critique by students and staff of work in progress that takes place periodically throughout the course. [↑](#footnote-ref-10)
11. In addition to the core faculty, there are a number of associate lecturers and visiting specialists, alongside alumni feeding back into the course where possible. [↑](#footnote-ref-11)
12. Unusually for an art school, CSM has an in-house Fine Art Maths Centre. [↑](#footnote-ref-12)
13. ‘Matter | Method | Material’ is a Forced Connection exercise, devised by Heather Barnett, where different elements are randomly combined, as a means of encouraging multiple possibilities for creating connections and generating creative ideas. Frequently it is run as a thought experiment in creative thinking workshops. Here it is run as a practical experiment, where students are requested to turn the ideas into practice. Such methods are discussed in Barnett 2012. [↑](#footnote-ref-13)
14. The project is discussed in the context of the *Practices of Enquiry* exhibition and workshop here: <http://www.artsciencecsm.com/forced-connections-and-rules-of-random/>] [↑](#footnote-ref-14)
15. Developed by Adrian Holme 2009, the critical method is broken down into four stages Describe, Analyse (and Contextualise), Interpret, Evaluate, and practised first upon an object. [↑](#footnote-ref-15)
16. Students are asked to design and build an ‘objective drawing device’, which they then test in the studio with a life model. The impossible task raises questions about instrumentation and representation, which are explored in practice and in discussion on the devices made and the drawings produced by them. [↑](#footnote-ref-16)
17. Modified from a method of David Webster of University of the Arts London [↑](#footnote-ref-17)
18. To see the full extent of collaborations offered through the course, see the ‘Collaborations’ page on the course website at <http://www.artsciencecsm.com/collaboration> (MA Art and Science 2019) [↑](#footnote-ref-18)
19. Lumen Atina residency is an annual astronomy and photography residency organised my MA Art and Science graduates Melanie King and Louise Beer. Many of our student and graduates join the residency each year. [↑](#footnote-ref-19)
20. Labverde is an international competitive residency situated in the Amazon. Participants include MA Art and Science graduates Aleks Borys (2016) and Helen Cawley (2018). [↑](#footnote-ref-20)
21. Several students have exhibited in Science Gallery exhibitions whilst studying, lead public participation activities for Wellcome Collection Reading Room and engaged in the myriad of opportunities within the wider Central Saint Martins and University of the Arts artistic communities. [↑](#footnote-ref-21)
22. The conception and design of the GrowLab acknowledges examples of other art/science laboratories, most notably ASCUS in Edinburgh (who provided consultation for the Growlab), Incubator Lab at University of Windsor, Coalesce Bioart Lab in Buffalo, and Symbiotica in Western Australia, as well as open biology public laboratories such as GenSpace in Brooklyn and the Waag Society in Amsterdam. [↑](#footnote-ref-22)
23. The first scientist in residence visited in connection with a transcultural / transdisciplinary collaboration between Central Saint Martins and Tokyo Institute of Technology in Autumn 2019. [↑](#footnote-ref-23)
24. Further underpinned by the introduction a new interdisciplinary Masters course in Biodesign in Autumn 2019 [↑](#footnote-ref-24)