Where science ends, art begins? Critical perspectives on the development of STEAM in the new climactic regime

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INTRODUCTION: CRITICAL PERSPECTIVES ON THE MOVEMENT FROM STEM TO STEAM

This contribution explores the origins of movement from STEM to STEAM, with a view to troubling the epistemological assumptions that underpin what at first glance appears to be a progressive and ameliorative project. STEAM appears to challenge traditional educational modalities (such as clear divisions between disciplines) in order to provide a broader canvas for human enquiry. In contemporary terms, we might even say that the movement from STEM to STEAM – that is to say adding “arts” to the study of science, technology, engineering and mathematics (STEM) – is perceived to “add value” to a pre-existing initiative. And yet the very notion of “value-added”, namely the amount by which the value of a commodity is increased by each stage in its production, encapsulates the economic imperative that pervades contemporary educational discourse. It is perhaps not surprising, then, that this same economic imperative also appears to have been a key driver of the movement from STEM to STEAM. As we shall see, this has had some rather unfortunate consequences. I suggest that these have ultimately been to the detriment of a broader understanding of the inter-relationship between apparently disparate areas of human enquiry, such as the arts and sciences. I shall also attempt to demonstrate that the focus on the economic imperative has also led to an impoverished understanding of the nature of scientific and artistic practice per se. Even more importantly, it has prejudiced our capacity to respond to environmental challenges. This chapter puts forwards an alternative conception of knowledge in order to foreground new educational relationships and modalities.

My main aim here is to develop a more nuanced understanding of the inter relationship between the arts and sciences. This will clear the ground for a reassessment of the nature of teaching and learning in these areas. I shall examine the role of the arts in enhancing human sensibility, with a view to counterbalancing what I consider to be a constructive misreading of scientific knowledge as being primarily about facts rather than values. As we shall see, scientific inquiry is about more than a detailed understanding of empirical processes: it also serves to cultivate a sense of wonder. I shall draw inter alia upon the work of Bruno Latour (2016) in order to explore the inter-relationship between sciences and the arts. He uses the term “new climactic regime” to refer not just to climate change but also to “the whole range of climates that have been modified”. Latour refers to the ideal climate for producing wine, i.e. the particular combination of weather conditions, soil, temperature, cultivation practices, etc. In the case under consideration here, the term ‘new climactic regime’ would include the modifications to the discourse of education in recent years that have seen increasing emphasis on harnessing education to the ends of increased performativity and enhanced economic performance; and constructions of science and art that place them in different silos in an educational context. Reconceptualising
the inter-relationship between sciences and the arts has the potential to bring us back from a different planet, as it were. It is only by considering the arts and sciences from the inside rather than as reified categories that can be progressively realigned that we shall be able better to inhabit the Earth and to address the many challenges that we currently face. I shall suggest that what is required in the contemporary era is not mere addition in the sense of “value added”. Rather, what we need now is a more progressive project that entails the re-entanglement and re-enchantment of the ethical, political, moral, aesthetic and scientific dimensions of human enquiry across disciplines and fields of inquiry. This entails further endorsement of the need to theorise the relation between affect and cognition in science education (Alsop, 2005: 3). I attempt to argue that both of these developments are necessary if we are to recalibrate our relationship with human agency and develop a more nuanced understanding of the relation between science and the arts. This will entail a fundamental reassessment of the nature of teaching and learning in both science and in art and design, although there is not scope to do so here.

As we shall see below, brash expressions of the salient role of human agency and systematic neglect of the non-human pervade the discourse on the movement from STEM to STEAM. In order to re-balance our relationship with the world around us, we need to give voice to the non-human or the more-than-human, especially in these fragile times. This is vital if we are to ground ourselves more firmly in and on the Earth, and if we are to be of and for the Earth, rather than to float above it in a disembodied way, or metaphorically to shoulder the globe like the enfeebled descendants of Atlas. This rebalancing exercise will enable us to reframe our present engagement with the complex, fragile eco-system to which we belong, and in due course to deepen our understanding of the nature of teaching and learning across the spectrum of human endeavour. Such an approach makes it possible for us to propose a far more radical agenda for change than that which is encapsulated by the current notion of STEAM.

It is worth bearing in mind that the common-sense understanding of steam, which is nothing other than hot air. This is an element that appears to be in chronic over-supply in the increasingly fragile environment in which we have our being. Perhaps what is required now is that we let some cool drafts of fresh air run across the surface of a notion that has become rather over-heated. Perhaps rebalancing our relationship with the Earth is simpler than we realise.

**FROM STEM TO STEAM: THE SUBORDINATION OF ART TO TECHNE?**

I shall begin by tracing the key moments in the movement from STEM to STEAM. The move to integrate the disciplines of science, technology, engineering and mathematics first became evident in the early 2000s. It gained fresh impetus following the publication of a report in the US entitled *Rising Above the Gathering Storm* (National Academy of Science, National Academy of Engineering and Institute of Medicine, 2007). This report bears the traces of the economic imperative as a key driver of educational change. It emphasised the links between economic prosperity, the “knowledge-intensive” jobs related to science and technology, and the level of (scientific and technological) innovation that were perceived to be necessary in order to address pressing societal problems.

I shall now briefly consider the origins of the kind of narrow instrumentalism that pervades *Rising Above the Gathering Storm*. I think this is a necessary, if slightly unorthodox move in terms of the current debate on STEAM, especially as the hollow mantras of “economic competitiveness” and “global reach” simultaneously
misrepresent the nature of intellectual enquiry and render us insensitive to the manifold challenges we face in the “new climactic regime”.

One of the arguments advanced in this chapter is that contemporary rhetoric concerning the movement from STEM to STEAM places major obstacles in the way of thinking about the nature of intellectual enquiry, particularly when it comes to challenging the established orthodoxies inherent in giving STEM a fresh head of STEAM. As the attentive reader will already have discerned, I think this is unlikely to be achieved by subordinating art to narrow instrumentalist ends. Nor is it likely to be achieved by regarding science, engineering, technology and mathematics as unified, reified entities, without considering their multiplicity and foregrounding the production of interests that have led to the ascendancy of one field over another, or one sub-field within a field. By the same token, to adopt a narrow, instrumentalist view of art would be to run the risk of reducing it to the now obsolete sense of craft (ars in Latin; and τέχνη in Greek). It would also serve merely to reinforce existing hierarchical relations between science, technology, engineering and mathematics on the one hand and arts on the other. In the case of the movement from STEM to STEAM, there is a danger that art is regarded as a means of supplying what is required by science, technology, engineering and mathematics in order to generate “novel” and “creative” solutions to pressing social problems; and science, engineering, technology and mathematics, writ large, as it were, might be considered to draw upon what art (writ large) provides, for example, “igniting passion and interest in kids” (Rhode Island School of Design: https://www.risd.edu/). It appears that what all this boils down to is that that addition of the letter A to the acronym STEM does not challenge the primacy of science, technology, engineering and mathematics over the arts in both the public imagination and in public policy. Moreover, it discursively positions science as the preserve of cognition and affect as the preserve of the arts, thus reinforcing outmoded stereotypes. The philosopher and historian R.G. Collingwood’s observations on aesthetics, first published eighty years ago, refer to the primacy of the economic imperative and thus continue to resonate today:

We are apt nowadays to think about most problems, including those of art, in terms either of economics or of psychology; and both ways of thinking tend to subsume the philosophy of art under the philosophy of craft. To the economist, art presents the appearance of a specialized group of industries; the artist is a producer, his audience consumers who pay him [sic] for benefits ultimately definable in terms of the states of mind that his productivity enables them to enjoy. To the psychologist, the audience consists of persons reacting in certain ways to stimuli provided by the artist; and the artist’s business is to know what reactions are desired or desirable, and to provide the stimuli that will elicit them. (Collingwood, 1958 [1938]: 19)

This reductionist vision of art as “handmaiden” to the sciences is evident in contemporary discourse around the notion of STEAM. For instance, in “Gathering Steam on Rhode Island”, a news item on the website of the Rhode Island School of Design (RISD), one of the world’s leading design schools, claims made by the President of the School are set out as follows:

Through tools such as data visualization and modelling, artists and designers are already working to make science understandable and real, and helping people to understand complex issues. By injecting art into the innovation dialogue, STEAM will help the country stay competitive in the 21st century.
In this section, I have drawn readers’ attention to the limitations of traditional modalities of educational thinking. In sum, these place science on one side of a line that nobody drew and art of the other. I have also examined the implications of “injecting art into the innovation dialogue”. An “injection” of art might enhance functionality, as it were, but it will not cure the patient lying spread-eagled on the table of a fundamental malaise. We shall explore the development of STEAM further below, in relation to trends that were evident in the European education policy area around the same time.

**TRACKING THE GATHERING STORM**

It is important to note that the policy developments relating the movement from STEM to STEAM in the US resonate with what was happening in education policy in Europe in the same period, especially in the “gathering storm” that heralded the economic crash of 2008. The central aim of the Lisbon Strategy (2000), the European Union’s overarching programme focusing on growth and jobs, was to make the EU “the most dynamic and competitive knowledge-based economy in the world, capable of sustained economic growth with more and better jobs and greater social cohesion” (European Commission, nd). As Pirrie and Thoutenhoofd (2013: 615) point out, the emphasis on competition with a view to securing economic advantage that remains at the heart of the European education policy agenda is “entirely consonant with the economic foundations of the European Commission, founded in 1957 as the European Economic Community (EEC)”. In an increasingly fractured Europe marred by the resurgence of identity politics, encapsulated and expressed in the vote for Brexit, the ideal of greater social cohesion seems a more distant prospect than ever – at both local and national levels. Latour (2016) suggests that the resurgence of identity politics, coupled with a desire to return to the land of old (‘Make America great again’) is a direct result of the gradual realisation that the notion of the ‘globe’ is utopian rather than topian. Given the relevant co-ordinates favourable weather conditions and minimal infrastructure on the ground, a skilled pilot can land a plane at a particular point on earth. He cannot, however, land it anywhere on the globe.

It is also worth noting that the extent to which narrow, functionalist understandings of “technological innovation” have served to promote the public good and address pressing societal problems. Indeed it is open to debate whether or not the primary purpose of technological innovation is to contribute to the accumulation of capital and ever-wider social division rather than to promote social good. It is, however, far from clear that (economic) “growth” is an unquestionable good. Several commentators have pointed out that the relentless focus on growth and making a contribution to the “knowledge economy” has had a pernicious effect on education at all levels. Nearly a decade ago Gillies (2012: 240) drew attention to an unintended outcome of the emphasis on human capital theory in EU policy discourse: namely, that “the only valued aspects of education become those which have a direct, economic, wealth-generating impact”. The emphasis on economic growth may also explain the focus on cognition rather than affect noted by Alsop (2005) in relation to science education, although there is not scope to explore that here.

Stefan Collini has roundly endorsed the view expressed by Gillies by mounting a rigorous defence of the humanities in higher education. As he has pointed out, the value of scholarship in the arts and humanities, and to some extent in the social sciences, cannot be viewed solely in terms of its contribution to economic prosperity (Collini, 2012: 100). He explains in the following terms:
Even if it is allowed that there might be some non-material benefits from education for the individual – in terms, perhaps, of self-fulfilment or enhanced intellectual capacity – there is still a tendency to confine any possible social good to the usual litany about ‘productivity’, ‘competitiveness’, ‘innovation’, and ‘growth’. The discourse tends to be structured so that the non-economic is equated with the private, the economic with the public. (Collini, 2012: 99)

In terms of our current purposes, the following questions arise. Has the movement from STEM to STEAM challenged or merely endorsed these fundamental assumptions about the predominance of the market order? To what extent, if at all, has the shift from STEM to STEAM troubled conventional lines of demarcation between what are widely assumed to be radically different areas of intellectual enquiry? Are science, technology, engineering and mathematics still consigned to one side of the equation, as it were, and arts on the other? Do such divisions (which, incidentally, are to some extent reflected in the very structure of this book) reflect the complexity of intellectual enquiry in fields as diverse as the applied parts of engineering, medicine or theoretical physics, or in digital media, fine art or textile design? Do such divisions between the arts and sciences writ large, as it were, merely reinforce what Stefan Collini (2012: 101) describes as the “hackneyed contrast” between the humanities and sciences? As we shall see, this latter distinction is encapsulated in the now largely discredited notion of “two cultures”. This fails to take account of the manner in which the distinctive aesthetics of science, politics and the arts can be re-aligned and intertwined in order to advance not only our thinking in relation to the complexity of human enquiry, but also to the complexity of our environment and our understanding of our place within it.

At this point it is useful to be reminded of the definition of environment, namely, “the conditions or influences under which any person or thing lives or is developed” (The Shorter Oxford English Dictionary). The environment is not something “out there” upon which we can exercise our influence either as rational actors or agents of destruction, depending upon the discourse to which we subscribe. We are part of the environment, in much the same way that we are time. We are enveloped within the environment, just as we are enveloped within time. The fundamental shift in thinking required here is that phenomena such as the environment and time are not (simply) “resources” or “commodities” that we can waste or save. Rather, they are part and parcel of the very fabric of our lives.

This chapter marks an attempt to formulate some answers to some of the questions raised above. More specifically, it paves the way for an alternative conceptualisation of the inter-relationship between science and the arts. This runs against the current of the pervasive discourse of the market and a higher-education environment dominated by the market order. This contribution will also serve as a place marker for wonder, hesitancy and doubt. As Alsop (2005: 4) points out, these are qualities that run through the sciences as well as the arts. My aim here is to attempt to reassert the value of “challenge, surprise, desire, joy, expectation and mystery” (Alsop, 2005: 4). It is also to stand up for the value of looking sideways rather than rushing headlong in pursuit of some pre-determined end, as in the case of from STEM to STEAM, or to track the gathering storm in the manner of a disinterested meteorologist. After all, we need to ask ourselves what exactly is it that we are pursuing? Are we merely glancing like Narcissus into “a muddy pond of abstract nouns in which all distinctiveness gets lost” (Collini, 2012: ix)? The many variants on the theme of the globe (“global”, “globalization” and the associated terms “international” and the ugly neologism “internationalization”) that are evident in
contemporary educational discourse are prime examples of the latter. Are we eagerly anticipating a future that will never come? Or are we invoking a vision of a future that we negate with our relentless focus on human agency, target-setting and a cavalier disregard of the life of things in the here and now?

THE “TWO CULTURES” DEBATE: SCIENCES VERSUS HUMANITIES?

Let us briefly return to the notion of “two cultures” referred to above. The English novelist and physical chemist C.P. Snow coined the term “two cultures” in 1959 at the Rede lecture at the University of Cambridge. He invoked this expression to describe what he regarded as a fundamental division between the arts and sciences as distinctive modes of enquiry. This is an idea that continues to exercise considerable traction, despite the fact that, as Collini (2012: 101) points out, “there is no coherent intellectual basis for this conventional distinction – not in method or subject matter or purpose”. In addition, the nature of scientific enquiry itself has become increasingly diverse in the intervening decades, as indeed has the range of what would be broadly classified as “arts”. Collini goes on to suggest that “two cultures talk has its main current home, as it had its origins, among those who feel some kind of cultural insecurity about their identities as scientists or among those who administer science rather than do it” (Collini, 2012: 101). In his view, there is an inverse relationship between the level of scientific acumen displayed by particular individuals and the degree to which they espouse the notion of the two cultures:

Indeed, as a rough rule of thumb we may say that the more distinguished the scientists are at their science, the more readily they acknowledge the shared character of intellectual enquiry and the more they are willing to make common cause with their colleagues in the humanities against various ways of talking (or measuring) that misrepresent this. (Collini, 2012: 101).

The writing of the theoretical physicist Carlo Rovelli bears the hallmarks of the best work in the humanities, offering us a unique glimpse into the inner life of physics. In his recent book *The Order of Time*, Rovelli (2018) brings together science, philosophy and art to unravel one of the greatest mysteries: the meaning of time. Paradoxically, the temporal order that underpins the relentlessly future-oriented movement from STEM to STEAM, which is characterised by an unwavering commitment to the principles of competition and the goal of economic advancement, invokes the Newtonian order of time. As Rovelli explains, this has largely been discredited, and not merely as the result of advances in theoretical physics. Rovelli draws upon sources as diverse as the ancient philosophers Aristotle and Anaximander, the poet Horace, the painter Matisse, and, in the extract below, The Beatles, to demonstrate that time is not absolute, true and mathematical as Newton suggested, but rather relative, apparent and common. In short, time does not flow uniformly outside us. Rather, time resides within us: we are time. And as Rovelli reminds us, our apprehension of the mystery of time is not entirely rooted in our rational selves, nor can it be entirely expressed in such terms. In the short passage below, cognition and affect are intertwined:

We are glimpsing something about the mystery of time. We can see the world without time: we can perceive with the mind’s eye the profound structure of the world where time as we know it no longer exists like the Fool on the Hill who sees the Earth turn when he sees the setting sun. And we begin to see that we are time. We are this space, this clearing opened by the traces of memory inside the connections between our neurons. We are memory. We are nostalgia. We are longing for a future that will not come. (Rovelli, 2018: 175)
While we are on the subject of dichotomies – a theme that pervades this book and to which we shall return in due course – it is important to note that the notion of “two cultures” did not suddenly come into existence in the 1950s. It was also very much apparent in the Romantic era, and most acutely during the first scientific revolution of the seventeenth century. This is a period that is generally associated with such luminaries as Isaac Newton (1642-1726), Robert Hooke (1635-1703), John Locke (1632-1704) and René Descartes (1596-1650). As Holmes (2008: xvi) points out, the first person to refer to a “second scientific revolution” was (ironically enough) “probably the poet Coleridge in his Philosophical Lectures of 1819”. Holmes describes the evolution of “Romantic science” in the following terms:

It was inspired primarily by a sudden series of breakthroughs in the fields of astronomy and chemistry. It was a movement that grew out of eighteenth-century Enlightenment rationalism, but largely transformed it, by bringing a new imaginative intensity and excitement to scientific work. It was driven by a common ideal of intense, even reckless, personal commitment to discovery… This is the time I have called the *Age of Wonder*, and with any luck we have not yet quite outgrown it (Holmes, 2008: xvi)

*Excitement. Intensity. Imagination. Discovery. Recklessness. Wonder.* Readers are invited to hold these words in their imagination, as a powerful antidote to the anodyne “biz-speak” that permeates contemporary education policy and the reductionist view of science and the arts as key drivers of “innovation” in a competitive, “knowledge-based” economy. The opening words of this paragraph disrupt the Cartesian tradition by foregrounding attitudes towards science as well as scientific attitudes (Alsop, 2005: 7). They also serve to remind us that there is also a “softer “dynamic” science of invisible powers and mysterious energies, of fluidity and transformations, of growth and organic change” (Holmes, 2008: xviii). This is evident in the quotation from Rovelli above. Elsewhere in his recent book *The Order of Time* he speculates that “perhaps poetry is another of science’s deepest roots: the capacity to see beyond the visible” (Rovelli, 2018: 21). Excitement, intensity, imagination, discovery and recklessness are necessary correctives to the modernist commitment to the more anodyne and colourless terms (productivity, innovation, competitiveness and growth) that have joined forces with a pre-existing emphasis on scientific rationality to signal a radical detachment from the material world. As Collini (2012: 101) has observed, it is often the case that distinguished scientists “are willing to make common cause with their colleagues in the humanities” and to resist the silo mentality that is often associated with research administration. Once again, Carlo Rovelli is a particularly eloquent case in point.

**VOYAGES OF DISCOVERY**

It is entirely fitting that Holmes (2008) locates “Romantic science” between two famous voyages of exploration: Captain James Cook’s first round-the-world expedition on the aptly named *Endeavour* (a three-year voyage that began in 1768) and Charles Darwin’s voyage to the Galapagos islands aboard a ship named after a scent hound, the *Beagle* (begun in 1831). The idea of the exploratory voyage – lonely, perilous, and without predetermined ends – is far removed from the narrow teleological focus that frames contemporary scientific endeavour, at least as it manifests itself within a policy discourse of competitiveness and sustained economic growth. The hallmark of Romanticism as a cultural force, irrespective of whether its exponents were scientists or artists, was a sense of awe, reverence and wonder and embodied engagement with sea, sky and starts. “Wonder is the source of our desire
for knowledge” (Aristotle, *Metaphysics* I, 2, 982). It is no small wonder, then, that this quotation appears in the opening pages of *The Order of Time* (Rovelli, 2018).

This gradual alignment between science and the arts was not all plain sailing, so to speak. Sometime between 1795 and 1895, William Blake (1757-1827), a seminal figure of Romanticism whose own artistic practice spanned poetry, painting and printmaking, completed a deeply satirical work entitled Newton, in the form of a watercolour-finished print. Alan Moore, an artist and writer who specialises in comic books, is perhaps particularly attuned to the qualities of caricature present in Blake’s work. Moore (2014) describes Blake’s portrayal of Newton is the “two-dimensional original of Eduardo Paolozzi’s RA’s titan British Library doorstep”. The scale and durability of Paolozzi’s bronze (1995), located on the threshold of a major seat of learning, only serves to remind us of the longevity of the “two cultures” dichotomy and the influence it continues to exert upon contemporary thought, including the movement from STEM to STEAM.

Blake’s vividly satirical critique of what he considered a reductive scientific approach depicts a young Isaac Newton bending intently over a diagram that he is in the process of drawing with a compass. The taut and muscular figure seems entirely oblivious to the complexity of rock formation upon which he is seated. The rock is coated with algae, the intricate patterns and subtle colours of which are evident to the viewer. Newton appears to be submersed — literally — and yet he also appears to be “sitting as if in judgement far above at least the intellectual cosmos”. Rapt in thought, Newton seems transfixed by what appears to be a simple line diagram on a parchment roll that emerges from a white drape. This gesture towards a celestial, other nature — the disembodied rationality and objectivity of scientific enquiry. Engrossed in “pure geometry without complications”, Newton appears to be “immune to the more fractal charm” of the blue and orange lichens that are spattered across the rock formation. Blake could not forgive Newton for privileging rational thought above the spiritual dimension of human experience, and for directing his gaze away from the complexity, intricacy and subtlety of the world around him. In a poem contained in a letter addressed to his patron Thomas Butt, Blake (1802) expressed his fervent desire for a broader vision of the world and man’s place within it:

May God us keep  
From single vision and Newton’s sleep.

This bears repetition in the context of a discussion of STEAM. Indeed, we might wish that contemporary theists might implore God to keep us from a single, blinkered vision of economic growth. It distorts our sense of our place in the world as well as the nature of scientific and artistic endeavour.

William Wordsworth (1770-1850) offers a different perspective on the “single vision” of scientific objectivity that was the subject of Blake’s critique. As a student at Cambridge, Wordsworth frequently encountered the full-size marble statue of Newton in the stone-flagged entrance to the chapel of Trinity College. Repeated engagement with this statue brought forth a rather different vision of Newton, one that challenged common understandings of the nature of scientific enquiry as a rational, value-neutral pursuit. Holmes (2008: xvii) describes how Wordsworth “animated this static figure, so monumentally fixed in his assured religious setting. Under Wordsworth’s optic, Newton became a haunted and restless Romantic traveller amidst the stars”, as is evident from this extract from *The Prelude* (1850):

And from my pillow, looking forth by light
Of moon or favouring stars, I could behold
The Antechapel where the statue stood
Of Newton, with his prism and his silent face,
The marble index of a Mind forever
Voyaging through strange seas of Thought, alone.

Suffice it to say that in the contemporary world of hyper-connectivity, those who “voyage through strange seas of thought” are generally treated with a degree of circumspection, if not downright suspicion. But we shall let Newton rest for now. Alternatively, we might imagine him “voyaging through strange seas of thought” in a manner that is barely distinguishable from the modus operandi of a scientist of the Romantic era, or a poet or artist from the same period. Yet there is one important difference. In the former case, the vision is planetary, disconnected from the earth. In the latter, epitomized by Wordsworth, the loving gaze is cast upon a host of golden daffodils embedded in the earth. We shall return briefly to this theme in the concluding section of this chapter.

Now it is time to engage in the art of time travel, to vault across several centuries and to turn our attention to the origins of STEAM. Let us begin by considering developments at the prestigious Rhode Island School of Design (RISD), where the concept of STEAM originated.

**GATHERING A HEAD OF STEAM**

STEAM certainly has an august pedigree. It emerged from a renowned stable, namely the Rhode Island School of Design (RISD) in around 2011. Founded in 1877, the RISD was one of the first independent colleges of art and design in the US. It regularly features amongst the top design schools in the world.1

It is clear from the promotional material on the RISD website that part of the rationale for the development of STEAM was to maintain the School’s leadership role in an increasingly competitive market environment. The economic imperative and the pressing need to “come up with novel and creative solutions to challenging problems” are evident in the language used on the website to describe the initiative. STEAM is regarded as a natural continuation of 19th century advances in science and technology. The mission of STEAM is couched in a narrative of continuous progress:

Like the sweeping changes in the 19th century, RISD’s STEAM initiative also aims to spur an innovation revolution, create jobs, and help Rhode Island and the nation maintain a leading edge in the global marketplace.

The objectives of the STEAM movement as set out on the RSID website are as follows: “to transform research policy to place Art + Design at the center of STEM; encourage integration of Art + Design in K-20 education [i.e. schooling and participation in education by people of all ages]; and influence employers to hire artists and designers to drive innovation”. The rationale for the movement from STEM to STEAM is “to spur economic progress and breakthrough innovation”, “to inspire a generation of creative problem-solvers” and to enhance “employability” amongst artists and designers.

The dissemination of STEAM across the world is rendered visible through an interactive map that portrays the initiative as a series of inter-connected nodes spread across the globe. According to text that was available on the RSID website, the launch of the “global STEAM map” in 2014 enabled “individuals and organizations

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involved in the movement … [to] add information about themselves to the online tool as a means of sharing their ideas, activities and successes in this arena, connecting with others and showing the growing level of support for STEAM worldwide”. This reinforces the impression that the STEAM project is all about momentum and growth, and that this can be depicted in terms of nodes plotted across the surface of the globe. The movement from STEM to STEAM is about moving on, inexorably. It is about achieving coverage and leaving the past behind us. Yet paradoxically this also entails a vision of the future that is dictated by practices that are rooted in the past. It is about paying homage to the Newtonian order of time. This represents a missed opportunity fundamentally to reconsider the aesthetics of science, politics and art in the new climatic regime. It is only by engaging in the latter that we shall be able to trouble the traditional distinction between science and the arts and arrive at a more future-oriented philosophy of knowledge. Reconsidering the aesthetics of science, politics and art in these troubled and troubling times will also enable us to recalibrate our relationship with the Earth. This involves a fundamental re-evaluation of the lines of demarcation between humans and non-humans, just as it did of those between artists and scientists.

CONCLUSION: FACING GAIA

Bruno Latour characterises these three discrete forms of aesthetics referred to above as follows. The aesthetics of science refers to a lack of sensitivity to any change in climate without instrumentation and the “vast machine” of multiple scientific disciplines. We might refer to this as the further enmeshment of STEM. The aesthetics of politics is characterised by lack of representation of human and non-human entities without the “highly complex procedures of activists and politicians building common concerns”. The hallmark of the third term of reference, namely the aesthetics of the arts, is a lack of sensitivity to the contradictions, complexities, novelty and scale of the entanglement of humans and non-humans. In the case of the movement from STEM to STEAM, it falls to science, engineering, technology and mathematics to harness the power of art to drive a particular political and educational agenda. This is a political landscape that is devoid of people, let alone “activists and politicians building common concerns”. The non-human, and indeed the more-than-human (the transcendent) seem to have been driven out of the picture entirely. What is at stake in the movement from STEM to STEAM is a complex game that consists in pushing glossy and anodyne substantives (growth, economic competitiveness, globalization, internationalization) across a smooth surface, one that is entirely divorced from the deep rock, the soil and the upper atmosphere in which we have our being. Science has ceased to be topian in the sense depicted by Blake’s study of Newton. We might almost say that STEM has branched out. Yet this playful organic metaphor belies the fact that it has become a vast machine, part of the military-industrial complex, and that it has been harnessed to the logic of sustained (yet unsustainable) economic growth. Science, like art, is seen from the outside, rather than from the inside (as I attempted to do in my brief exploration of Blake’s Newton). Art has been added to provide edge, gloss and a simulacrum of soul to an essentially utopian project (i.e. one that is related to the globe) rather than a topon project (i.e. one that is rooted in the earth and nourished by the atmosphere). Metaphorically at least, we have been “living on a different planet” for such a long time that we no longer recognise the Earth. She is now rising up to confront us with terrifying force.
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