**Chapter 7. The Human Ordering of the Arts and Sciences.**

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**Abstract.** The assumed typology in mental aptitude of even very young people, within the UK's educational culture ('Is she on the arts side or the science side?') is unusual both geographically and historically. Even in our universities, the disciplinary fragmentation we now experience ought to be thought of more as a two-century long experiment than as a fixed landscape of intellectual boarders. Recent studies on creativity (e.g. Howard Gardner's *Creating Minds*) and of neuroscience and culture (e.g. Iain McGilchrist's *The Master and his Emissary*) suggest that we have lost a holistic vision of the way human minds respond to their environment by recreating it in different, but integrated ways. A new study of comparative creativity (*The Poetry and Music of Science* (McLeish 2019)) indicates that an integrated ('ordered') human mind will operate across a continuous space of creative thinking spanned by the axes of artistic-scientific, cognitive-emotional and conscious-nonconscious. This chapter explores the backdrop of medieval philosophy, arguing that this backdrop, and especially the balance of *affectus* and *aspectus* of St Anslem and Grosseteste, provides a helpful 'distant mirror' in which to reappraise our educational and cultural concept of 'discipline', and on what we mean by 'education.'

## Introduction

In its 2014 statement on a twenty-year vision for education, the Royal Society, the UK's national academy of the sciences, and the global prototype of that class of institution, quoted a report commissioned from the Institute of Education, that:

> A combination of literacy, communicative, mathematical and scientific abilities is key to successful participation in pluralist, democratic societies, which increasingly rest on the assumption that their populations have access to information in a variety of modes, and are able to use it to inform judgement within work and community settings.[1]

The recommendation of the Royal Society *Vision* report[2], that the UK move to a broader and more balanced curriculum for 16-18 year olds, is set against the background of the current extreme narrowness of high school education during its final years in this country. For many years, employers, educationalists and researchers alike have advocated a move towards a baccalaureate-style of education common in many continental countries as well as in America, or at the very least avoidance of the current situation in which it is possible to study no science, or no literary subject at all after the age of 16. The quotation from the *Vision* report is representative – to navigate a future and rapidly-changing society calls upon

[1] Tolmie, A, Creese, B, Nelson, R, Block, J, Swain, J, Cara, O, Earley, P, Glauert, E, Harrison, M, Hoyles, C, Johnson, S, Levinson, R, Pratt, D & Reiss, M 2013 Report on leadership and workforce issues within UK Science and Mathematics Education.

[2] Vision for science and mathematics education.
The Royal Society Science Policy Centre report 01/14 Issued: June 2014 DES3090

narrative, numerical, literary and scientific knowledge. Such a breadth of awareness is not the only requirement – such educational foresight statements call for a grasp of the connectivity of disciplines that contemporary education is notoriously poor at presenting, and a flexibility of application. The challenges in making this move are considerable, especially after half a century of extreme specialisation, but also represent an opportunity to reflect holistically on the rationale and scope of education itself. Questions of balance arise: not only between the sciences and the humanities while respecting different individual aptitudes, but also between the academic and vocational, the creative and contemplative, the cognitive and the physical – all these enter any meaningful debate on the design of future curricula in a changing world.

A dominant theme is that of creating the new itself. A changing world must perforce contain actors who bring about that change, who innovate in fruitful and flourishing ways, whose imagination outpaces the automatic and the driven, and which anticipates the threats of unsustainable human behaviours. Yet 'creativity' is itself becoming an impoverished and increasingly thin concept. The term 'creative industries' has come to represent a rather narrow sector of the organisational landscape. Within businesses and other organisations, and at an individual level, the verbal noun 'creative' (in its application to human individuals) seems to have been annexed exclusively by marketing divisions. Science, in particular, is increasingly divorced from the notion of creativity – 'there is no room for imagination in science' asserted a presenter full face to camera in a recent BBC science documentary.

Paradoxically, the last century has increasingly valorised science over the arts and humanities in its dominant narratives, funding and educational priorities. Over the same period in which the notion of creativity has been displaced from the social framing of science, proponents of the arts and humanities have perceived the need to mount explicit defences of them. So, for example, John Carey in *What Good are the Arts?*, writes.

> Literature does not make you a better person, though it may help you to criticize what you are. But it enlarges your mind, and it gives you thoughts, words and rhythms that will last you for a life.[3]

Carey, in an earlier chapter in his personal survey of the arts, levels similar criticisms at the visual 'high' arts, especially in terms of their societal framing as, for the most part, received rather than actively engaged-in. In similar vein, Helen Small's *The Value of the Humanities* develops a list of functional attributes of the study of the humanities, none of which attempts to engage with the sciences, but rather counter-balances them. It is not my purpose here to evaluate her categorisation, but note the significance of her final summary, referring to Bernard Williams, where she relates public value to private affect.

> … we will find ourselves in trouble, as a society, if the ways in which we express and encourage important values drift too far from our private sentiments and intuitions about values.[4]

One could claim that these two examples represent echoes of an oppositional debate that has taken various forms over the last century, particularly in Anglo-American culture and typified by C. P. Snow's Reith lecture and subsequent book *The Two Cultures*.[5] The celebrated

[3] J. Carey (2006) *What Good are the Arts?* Oxford: Oxford University Press, p.260.
[4] H. Small (2013) *The Value of the Humanities* , Oxford: Oxford University Press, p.182.
[5] C. P. Snow (1959 [1998]), *The Two Cultures*. Cambridge: Cambridge University Press.

debacle between Snow and F.R. Leavis was neither the first example – it drew heavily on the earlier debate between Matthew Arnold and T.H. Huxley - nor the last (the so-called 'science wars' of the 1990s echoed the genre). Nevertheless, it bequeaths a moniker to the framing of a discussion from which it has proven hard to break free. Perhaps one reason for this is that the history of thought, and its disciplinary conventions within an educational context, has not been as deeply explored as it might. In particular, the medieval centuries, so foundational to modernism, yet without the stark divisions of humanities and sciences to which modernism had become so strongly wed, present themselves as potential sources for more fruitful reconciliation.

This chapter is one of several in this volume (in addition to chs. 9, 10 and 11) that take up the subject of education, setting current thinking and opportunity against the 'distant mirror' of a past century in which thinking on the topic was both radically different, and generally more profound, than it is in our age. By juxtaposing medieval ways of thinking and categories of connection with contemporary discussions of mind, education and creativity, we will find less of a clash of culture than a rich resource of imagination, an illuminator of connections then laid bare but now hidden, as well as a reminder of some contingent assumptions of modernism that have become inappropriately normalised. We begin with reference to the thirteenth-century polymath Robert Grosseteste's reflections on his own curriculum – the seven 'Liberal Arts' of the medieval universities.

## Grosseteste and St Anselm on the Liberal Arts

Robert Grosseteste prefaces the body of his published work on natural philosophy and scientific topics with a remarkable treatise on the seven liberal arts. Written probably in the period 1200-1215, it begins with the summary of high medieval philosophy of education.

> Now, there are seven arts that purge human works of error and lead them to perfection. These are the only parts of philosophy that are given the name 'art', because it is their effect alone to lead human operations towards perfection through correction. The works within our capacity consist either in the mind's sight, or in the desire of the same, or in bodily movements, or in the dispositions of these same movements. Sight first looks; then it verifies what has been looked at or cognised, and when the fitting or harmful things have been verified within the mind or within sight, desire covets to embrace the fitting, or retreats into itself to shun the harmful.[6]

Several surprising and strange notions surface simultaneously for a modern reader of this dense passage, as in the entire treatise that follows.

First, the arts, for Grosseteste, do not primarily support vocation or employment, but constitute vital *virtues* that underpin them. Their bipolar valence towards the good on the one

[6] R. Grosseteste (2019 [c.1215]) *De Artis Liberalibus* trans. S. Sønnesyn from Giles E. M. Gasper, Cecilia Panti, Tom C. B. McLeish, Hannah E. Smithson eds. *The Scientific Works of Robert Grosseteste* Vol. 1 *Knowing and Speaking: Robert Grosseteste's* De artibus liberalibus '*On the Liberal Arts' and* De generatione sonorum *'On the Generation of Sounds'*, Oxford: Oxford University Press.

hand, and the harmful on the other, serve to drive their possessors and masters towards the first and away from the second (as concerns not only they themselves, but others also). The surprise for modern sensibility increases when it becomes clear that the treatise's ethical development and orientation spends relatively little time on the lettered arts of the trivium (grammar, logic and rhetoric); rather its bulk is devoted to the mathematical arts of the quadrivium (arithmetic, geometry, astronomy and music), especially the last two.

Second, the consequence of a proper grasp and deployment of the arts is not so much the application of knowledge, as a holistic ordering of the human in operation and behaviour. Furthermore, the process is not one of mind-directed activity, but derives from a vision of interconnection of 'sight', 'desire' and 'bodily movement'.

Third, it is the interplay and dynamic of these three functions that achieves the fruitful rather than the harmful. The pursuit of disciplines is both a moral and ethical activity, but also an explicitly practical one. For Grosseteste personally, the context this work enjoys within his corpus is highly significant. Though dating of his treatises is notoriously difficult, in this case there is strong support for the conclusion that this survey of the liberal arts acts as a preface to his significant body of work on natural philosophy. That this contains a wealth of highly novel and imaginative proposals on the qualities and behaviour of light, sound and matter points to the aspect of creative fruitfulness inherent to his definition of 'the good' in respect of learning.

Fourth, the spectrum of disciplines is highly integrated in any account of praxis. The subsequent treatise details the ways in which virtuous human beings adopt the learning of geometry as much as logic, of astronomy as much as rhetoric, to order their worlds fruitfully.

The way in which the liberal arts work out within this scheme is alluded to and anticipated in the introductory passage above in a concise narrative account of what we might now refer to as a psychological process. 'Sight at first looks …' is the introduction of an account of experience. This 'sight' is not necessarily visual – here *aspectus* is invoked in its fully metaphorical sense of mental sight or vision. Similarly 'desire' is the complementary *affectus* elicited by the mind's cognition, but necessary to drive both further thought and subsequent action. We talk loosely today of acting from our 'head' or our 'heart', as if these were exclusive modes of motivation. But for a medieval thinker, the emotions and rationality were intrinsically intertwined. In many ways we are less subtle now, needing rather nuanced definitions of these two Latin terms:

> **Affectus** comprises the will, desire, or divine speculation. It has a greater projection onto the emotional than does *aspectus*, and less onto the cognitive or rational. It is the immediate motivator of motion or action. It responds more to the internal than the external, but can be directed by *aspectus*.
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> **Aspectus** is intellectual apprehension. It has a greater projection onto the cognitive and rational, and less onto what we would term the 'emotional' today. It acts on *affectus*, rather than acted on by it. It possesses a sense of inner perception, gently invoking the visual 'aspect' of cognition.

The two notions map approximately onto our language of cognition and emotion, but these are only the dominant components of their content. There is a palpable admixture of the affective in 'aspectus', as much of the rationally executed in the 'affectus'. If nothing else, this should warn us that any apparently clear distinction between the emotional and cognitive today is the result of as much cultural circumstance as it is psychological structure. For an early modern insight into the integrative interplay of emotion and rationality we might turn to perhaps a surprising witness in David Hume.

> By reason we mean affections …; but such as operate more calmly, and cause no disorder in the temper: Which tranquillity leads us into a mistake concerning them, and causes us to regard them as conclusions only of our intellectual faculties. [7]

This is a remarkable claim of a centrality of passion in the acquisition of scientific knowledge itself, not purely in the aesthetic enjoyment of its fruits. Yet it is a truth, if a suppressed one, that all scientists know. Furthermore, it presents an important diversity within affect: as well as the violent passions of joy and grief, there are the quieter ones that may even, for their persistent nature, be mistaken for the rational (*aspectus*). A salient example would be the 'aesthetic emotion' – the appreciation of beauty, which threads its way through the testimonies of both artistic and scientific creation, both as motivation and response. Keeping alert to such quieter emotions is important in gathering personal evidence on the creative phase of science, but doing so is to swim against the tide of current scientific narrative. If Hume was able to report, and even to analyse, the emotional thread of natural philosophy without controversy, it was because science was more honest about its passions in the eighteenth century.

An even deeper function of emotional affect emerges when its entanglement with the cognitive is appreciated within the context of creativity. There is a mutual collaboration of affect and cognition in the search for innovation, the creative solution, the imagining of the new. A celebrated modern example of honest self-reflection of the role of 'shadow emotion' in mathematical innovation is found in a personal account by French mathematician and mathematical physicist Henri Poincaré.[8] Faced with the universal experience in which the mathematician's conscious mind is suddenly presented with a clear perception of a pathway to the solution of a mathematical problem, he realises that the non-conscious mind has been at work during periods of apparent respite from conscious labour upon it. He also calculates that a purely unguided, mechanical function of checking possibilities is not a candidate for the way this subconscious process works: there are simply too many possible avenues within the space of candidate proofs for each to be checked exhaustively:

> What is the cause then, among the thousand products of our unconscious activity, some are called to pass the threshold, while others remain below? Is it a simple chance which confers this privilege? Evidently not; among all the stimuli of our senses, for example, only the most intense attract our attention, unless it has been drawn to them by other causes. More generally

[7] Hume, D. (2007) *Treatise Concerning Human Understanding*, Milligan, P. (ed.), Oxford: Oxford University Press.
[8] Henri Poincaré (1915), *Mathematical Creation*, in *The Foundations of Science*, trans. G. B. Halsted. Lancaster, Pennsylvania: The Science Press.

> the privileged unconscious phenomena, those susceptible of becoming conscious, are those which, directly or indirectly, affect most profoundly our emotional sensibility.[9]

Poincaré concludes that there are hidden aesthetic and affective functions that guide the non-conscious mind towards sub-spaces of fruitful ideas. He might have been developing a direct application by example from the medieval analysis of mental sight and affect. In this duality of *affectus* and *aspectus* Grosseteste's discussionn follows earlier thinking. Anselm anticipates Grosseteste by a century in describing the priority of sight before the emotion of love can engage:

> Of these, sight (aspectus) is like the exterior [part], because nothing arrives at desire (affectus) that does not first occur to sight. For nothing is loved unless it is first known.[10]

It is to Anselm that we also owe a detailed account of a personal example of the creative application of the disciplines, within a creative collusion of the affective and cognitive. It comes from the prologue to his major work, the *Proslogion*, and contains a striking example of the moments of unforced creative clarity that so impressed Poincaré:

> After I had published, at the solicitous entreaties of certain brethren, a brief work (the *Monologium*) as an example of meditation on the grounds of faith, in the person of one who investigates, in a course of silent reasoning with himself, matters of which he is ignorant; considering that this book was knit together by the linking of many arguments, I began to ask myself whether there might be found a single argument which would require no other for its proof than itself alone; and alone would suffice to demonstrate that God truly exists, and that there is a supreme good requiring nothing else, which all other things require for their existence and wellbeing; and whatever we believe regarding the divine Being.
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> Although I often and earnestly directed my thought to this end, and at some times that which I sought seemed to be just within my reach, while again it wholly evaded my mental vision, at last in despair I was about to cease, as if from the search for a thing which could not be found. But when I wished to exclude this thought altogether, lest, by busying my mind to no purpose, it should keep me from other thoughts, in which I might be successful; then more and more, though I was unwilling and shunned it, it began to force itself upon me, with a kind of importunity. So, one day, when I was exceedingly wearied with resisting its importunity, in the very conflict of my thoughts, the proof of which I had despaired offered itself, so that I eagerly embraced the thoughts which I was strenuously repelling.

[9] Henri Poincaré *op. cit.*
[10] Anselm, *Cur Deus homo* 2.13.

> Thinking, therefore, that what I rejoiced to have found, would, if put in writing, be welcome to some readers, of this very matter, and of some others, I have written the following treatise...[11]

Whatever one might think today of the logical, or theological status of Anselm's 'ontological proof' of the existence of God, there is no doubt of its ingenuity in assembling the rational apparatus of his day into a discussion of universals, and of the remarkable way that it touches upon modern notions of set-theory and self-reference. His account is also a 'text-book' example of the narrative of creative energies rightly directed that Grosseteste summarises in the treatise on the liberal arts. Anselm gives the background from which his vision (of a single argument) arose, and with it an 'earnest' desire. Industry, which brought it almost 'within mental reach' and constraint, which removed it from 'mental vision', immediately follow, together with the emotional 'despair' that marks the complete loss of sight towards the goal. There is a tangible sense of loss. Incubation in the form of attempts to 'exclude the thought altogether' precedes the illumination. In the form of a non-conscious process of imagination, so that to the conscious mind it appears as a gift ('the proof of which I had despaired offered itself') Anselm's experience elicits the emotions of eager rapture. The more sober process of writing the argument out leads his readers into the text itself.

Medieval reflections on the structure of human creative mental acts, together with rare but significant modern resonances, suggest that several dualities are at play. We have met with two – the dual tradition of the books of letters and the book of nature that take the form of trivium and quadrivium in the thirteenth century, and in the arts and sciences today, and the dual interplay of cognition and emotion that took its medieval form in the partnership of *aspectus* and *affectus*. We now turn to three other contemporary accounts that shed light on the dual structure of creative thought.

**Contemporary Dualities in Creative Thought: Three Accounts**

The last half century has seen somewhat of a resurgence in studies focused on 'creativity' itself, some recognising that innovation is an instrumental necessity of economic life, others more captivated by the ability to create *de novo* represents an essentially human attribute of the most treasured kind. In the latter class we find Howard Gardner's *Creative Minds'*.[12] Choosing his exemplars from the most outstanding imaginers of the new in science, art and politics (the reader encounters afresh Einstein, Picasso, Stravinski, Ghandi and Graham) he finds, notwithstanding, that the marvellous achievements of relativity, cubism, passive revolution or interpretive dance cannot be ascribed to a single locus of genius. They emerge, rather, from the connection of opportunity, extended devotion to hard work, personal emotive, as well as cognitive stimulation (in many cases this is a *deprivation* of resource, or personal affection) and a wide connectivity of ideas.

A salient example is the unusually well-documented case of Picasso's Spanish Civil War work *Guernica*. There is the outline of a distant goal in view, of great magnitude and inviting a strongly moral motivation – to describe in art an intensity of injustice and horrific suffering beyond words. Picasso's series of sketches throughout the summer of 1937 display periods of

[11] See full text at https://sourcebooks.fordham.edu/basis/anselm-proslogium.asp#PREFACE
[12] Howard Gardner (1993), *Creating Minds*, New York: Basic Books.

continuous development, and moments of radical shift. A vital narrative connection with the Biblical 'slaughter of the innocents' introduced, at a very early stage, a distorted representation of a woman in abject grief, clutching her dead child. She glides to different positions in the sketches, but finds her final framing position, at the extreme left of the canvas, by continuous development. On the other hand, a sudden modification midway through the painting's development brings the agonised horse into its central upper position. The eye is drawn back repeatedly to the agonised scream of this animal, rather than to the human figures of the work, which end up populating its periphery. This is a discontinuous and counterintuitive step. For it is principally the human suffering, and human cruelty, that the work concentrates on – that this contemplative goal is best refracted through the intervening central lens of a suffering animal was a remarkable discovery that released the final development of the work.

The artist is frank about the emotional drives of this work in particular:

> What do you think the artist is? An imbecile … He's at the same time a political being, consistently alive to heart-rending, fiery or happy events … No, painting is not done to decorate apartments. It is an instrument of war for attack and defence against the enemy.[13]

In *Guernica* and its documented development, we can see with unusual clarity the combined forces of the cogitative artistic skill, with their deliberate designs and distortions, their informed allusion to the narrative tradition of the artist's own culture, and his consummate draftsmanship, together with a continuous and felt emotional energy. Much of this is conscious, and directs the artistic skill towards the aspect, the final vision held in the conscious mind. But here, too, there is evidence aplenty that the affective currents behind and beneath the work manage to release discontinuous creative connections and ideas that, in hindsight, built essential pathways towards the final work.

The neural substrate of the *lateralisation* of the brain into two hemispheres is explored by literary scholar and neuroscientist Iain McGilchrist. In his magisterial *The Master and His Emmisary*[14] he investigates the structural basis for the multiple dualities of affect and cognition, of detailed labour and intuition of the whole, of immersion and abstraction, Insistent on taking leave of the simplistic and discredited identification of the left brain with cool scientific logic and the right with artistic creativity McGilchrist provides a neurologically-supported and nuanced account of the dualities that are notwithstanding present in the asymmetric human cortex. The emotional and cogitative, the holistic and reductionist and other dualities become viewpoints within a much more complex story.

It is tempting to conjecture that Robert Grosseteste's eight century-old discussion of *aspectus* and *affectus* might represent the recognition in a former age of the delicate interplay of left and right brain hemispheres. What is true neurologically today will have been the case in the twelfth and thirteenth centuries – cortical evolutionary timescales are much longer. We do, however, need to translate between metaphors, from a theological to a secular framing, and from one set of philosophical structures to another (and in addition from Medieval Latin to

[13] Pablo Picasso, Statement, in Chipp, *Theories of Modern Art*, 487
[14] Iain McGilchrist (2009) *The Master and His Emissary*, Yale University Press.

English, itself a far from straightforward operation). Listen, with that caveat in mind, to McGilchrist warning against an over-reliance on purely analytical over integrative thinking:

> Our talent for division, for seeing the parts, is of staggering importance – second only to our capacity to transcend it, in order to see the whole. These gifts of the left hemisphere have helped us achieve nothing less than civilisation itself, with all that that means. Even if we could abandon them, which of course we can't, we would be fools to do so, and would come off infinitely the poorer. There are siren voices that call us to do exactly that, certainly to abandon clarity and precision (which, in any case, importantly depend on both hemispheres), and I want to emphasise that I am passionately opposed to them. We need the ability to make fine discriminations, and to use reason appropriately. But these contributions need to be made in the service of something else, that only the right hemisphere can bring. Alone they are destructive. And right now they may be bringing us close to forfeiting the civilisation they helped to create.[15]

Ian McGilchrist might, in the age in which Grosseteste was writing, have expressed his warnings against the destructiveness of deploying left-brain analysis alone, as a failure to follow up 'seeing' with 'loving' or 'right desiring', or perhaps invoking the full subtlety of the medieval argument, as a failure to set in motion the virtuous circle of right seeing, judgement, desire and action. The *aspectus* seems in most respects to arise from left-brain properties. It analyses, judges – invokes the detailed work of language, and abstracts from particular situations to the general to do so. The *affectus* deploys more holistic, visual, immersive powers. It covers the inarticulate yet vital work of motivating desire, while also integrating, perceiving wholes rather than parts. Vitally, this integrative role of the right hemisphere applies not only to object but also to subject. Our very sense of self, including the integrated structures that bind together the linguistic and analytical pieces of left-hemisphere cognition, arises from the right hemisphere. This can occur in the context of emotion, as becomes all too obvious in careful studies in patients with dementia. As Douglas Watt[16] puts it, '*emotion binds together virtually every type of information the brain can encode … [it is] part of the glue that holds the system together'*. Here we seem to be calling on the multiple valency of *affectus*, which is not only a motivating force for individual acts, but one for the whole human being.

The present author has recently applied the case-study approach of Gardiner together with the cognitive perspective of McGilchrist to examine specific patterns of similarity and difference in the practice of arts and sciences.[17] Adding the further theological lens of critical teleology, and an emphasis on the testimony of artists and scientists with much lower profile (but arguably no less skill and imagination) than Gardiner's Olympians, *The Poetry and Music of Science* repeatedly encounters a narrative structure common to creative processes. Whether the aim in mind is a mathematical proof of a connection between phenomena in theoretical

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[15] Iain McGilchrist *op.cit.* p.93
[16] Douglas Watt (1999) At the Intersection of Emotion and Consciousness, *J. Consciousness Studies* 6, 6-7.
[17] Tom McLeish (2019) *The Poetry and Music of Science*, Oxford: OUP.

physics, or a symphony that escapes from Beethoven's shadow to find and resolve new harmonic territory, an interpretation of the faintest ripples of gravitational radiation, or the depiction in oil-paint of the light, breeze and ambiance of a Mediterranean coastal evening, the creators tell a common story. Their trajectory from desire and hope, through the experience of constraint and failure, to the eventual (in the happy cases) discovery of a way through, is so often repeated that it seems to qualify as a possible addition to Christopher Booker's well-known scheme of 'Seven Basic Plots', that attempts a categorisation of all basic storylines.[18] With, naturally, many specific and local variations, the human (as opposed to a divine) 'creation story' adopts a shape something like the following:[19]

*Vision* is the overwhelming metaphor for ideation, conceiving of what might be, but is not yet. In distant form, the vision might already glimpse an end, albeit poorly focussed.

*Desire* follows the first vision is much more entangled with the formulation of intellectual vision than a common dualism of cognition and affect would entertain. Vision and desire may generate each other.

*Industry* may constitute the activity of an individual, or a group or even an entire community. Driven by the vision and the desire to realise it, this marks the series of first attempts.

*Constraint* is the experience of frustration and failure, as initial notions prove flawed or inadequate, meeting with unanticipated constraints. It is essential to hear close testimony to find that art is no more a stranger to constraint than science – the form of poetry is only the most obvious example.

*Incubation* captures the consciously-fallow periods in which effort is relaxed and the network of pathways, methods, and constraints, is left apparently static in the face of apparently fruitless industry and insuperable constraint. This is also the house of 'shadow emotions' that work with a similarly veiled process of hidden cognition.

*Illumination*, never guaranteed, but always welcome is an apparently spontaneous and seemingly effortless upwelling of an idea from the non-conscious mind is the recognition of some new pathway out of the maze of industry, incubation and constraint.

*Verification*: the re-application of constraint is necessary throughout the final phase of industry – for 'knowing' that one ought to be able to complete the sonata or prove the theorem is not the same as having done it.

*Arrival*: the creative pilgrim's progress is over when all final painting-in, symbolic detail, chapter writing, working out, checking, is done, and the original creative energies have found a form that respects both imagination and constraints, a pathway from the original vision to a final work. The end may, and often does, look very different from the original idea. It may even assume the form of an opposite.

A close re-reading of the autobiographical passage from Anselm quoted earlier reveals all of these stages at work in his own experience of creating the *Proslogion*. The medieval period

[18] Christopher Booker (2004) *The Seven Basic Plots*, London: Bloomsbury Press.
[19] This scheme may be viewed as an expansion of a four-point process due to Graham Wallace (1926),*The Art of Thought*, TunbridgeWells: SolisPress (2016).

was one that seems to have fostered a deeper self-perception, possibly the result of a more structured and meditative disciplinary mental life of habit.

It would be foolish to over-claim here: there is no claim that all creative processes are identical or that there is no more than superficial distinction between disciplines. Neither am I urging a naïve assumption that medieval categories can be transplanted wholesale without translation into the late modern context. However, the most salient differences in accounts of creativity do not, on close inspection, present themselves aligning across the arts and sciences, nor to distinguish between medieval and modern. Nor would one expect them to, when they draw on the very deepest levels of the creative drives that participate in defining humanity. A more faithful, and helpful scheme, identifies creative aptitude that engages three 'modes':[20] the visual, the textual and the abstract. The first contains both visual imagination in science and the visual arts. The second follows the textual play of metaphor, the creativity within constraint that is poetry, and the entanglements of those connected ideas of artificially-created sub-worlds that constitute both the writing of novels and the tradition of experimental science. The third discovers both the wonders of mathematics and music in the wordless and image-less place where one might expect nothing at all.

## Educational consequences

This chapter is not alone in finding that disciplinary journeys that start with medieval conceptions of the liberal arts, and then follow the history of their reception on roads that stress commonalities, rather than differences, takes readers to a place in which the acquisition of knowledge itself plays a rather minor role. This is no celebration of ignorance, but it places knowledge in the context of a life or virtue, fruitfulness and creativity. In other words, it presents a pathway to the 'ordered human'.

There are recent and remarkable echoes of Grosseteste's language and thinking on the holistic way in which the rightly-ordered engagement of the disciplines, balanced and connected between thought, feeling and behaviour, can support the development of mental health. 'Metacognitive self-regulation'[21] is an evidence-based development in the theory of education that, notably, addresses the growing mental health problems within our schools and universities. It advocates a continuous reflection on the individual's responses to educational situations – in other words, recapitulating the sort of reflections, at a personal level, that *De artis libralibus* sets out to do.

Connected and balanced curricular encourage the same – the *Theory of Knowledge* module within the International Bacclaureate curriculum is intended, primarily, as a metacognitive guide to epistemology, but pupil reports indicate that its presence within the IB curriculum assists in the personal development of those that follow this highly successful post-16

[20] Tom McLeish, *op. cit.*
[21] Dusana Dorjee (2016) *Front. Psychol.*, **7**, 1788.

pathway in precisely the self-reflective and practical sense advocated by metacognitive self-regulation.[22]

It is also encouraging to see curricula that emphasises cross-disciplinary connections under development in many places within the UK. [23] To quote John Carey once more: 'metaphor is the gateway to the unconscious'.[24] Metaphor is the connection of pathways towards all creation of the new – as true in mathematics as in poetry. But it is also the connected mental sinew that integrates the self. The great medieval minds knew this – many moderns have forgotten it. But there are hopeful signs that we are rediscovering it.

[22] Higher Education Statistics Agency (2016), International Baccalaureate students studying at UK higher education institutions: How do they perform in comparison with A level students? Bethesda, MD, USA. International Baccalaureate Organization.

[23] See *e.g.* Billingsley, B. (2017) Teaching and learning about epistemic insight. School Science Review (365). pp. 59-64. ISSN 0036–6811., UCL Academic KS4 curriculum: http://www.uclacademylearningplatform.co.uk/category/grand-challenges/ , Sevenoaks School middle school curriculum: https://www.sevenoaksschool.org/msd/the-diploma/

[24] John Carey *op. cit.*