AESTHETIC PLEASURE OF BEAUTY AND ITS IMPLICATIONS FOR TEACHING AND LEARNING

Bryan Wijeratne
Queens' College, Cambridge
& School of Education,
University of Cambridge, UK

ABSTRACT

Aesthetic, affective learning which incorporates experience of the beautiful, the delightful, and the exciting, all of which relate to deep felt feelings and emotion are not given enough attention and recognition in the learning process by today's educational policy makers and managers. Instead, there is evidence that only cognitive learning that produce academic passes are regarded important and nurtured in the prevailing ethos of measuring success predominantly by written academic skills. The main thrust of this paper is to argue that effective learning might be made possible by affective, aesthetic means and that such learning 'delights as it instructs' and constitutes pervasive learning that learners achieve by love not labour. The paper discusses the notion of symmetry and aesthetics in relation to both visual and auditory modes of aesthetic perception. In exploring Renaissance themes - Leonardo da Vinci's motives for creativity - three are brought to the fore: first, the idea of art as a continuation of nature's own innovative tradition, second, the question 'what kind of universe can be created by verbal fiat' - how significant is language and the art of rhetoric?, and the third, the essentially interdisciplinary character of the creative process, a sort of 'unity of science' or coherence and integrity of knowledge at a fundamental level.

Humankind perceive, recognise, create, appreciate, and delight in, the beautiful from a variety of perspectives - art, poetry, music, anthropology, neuroscience, theoretical physics and the classics - which attests to a powerful argument that there are aesthetic absolutes in the external world, the physical universe, and the human mind is designed to apprehend them. Also explored is the evolutionary necessity of beauty, aesthetic pleasure and the delights of beauty itself. Recent classroom based research and fieldwork on the aesthetic experience of a range of learners from primary through secondary to tertiary levels are considered and discussed.

INTRODUCTION

That this paper is directed towards the teaching and learning of science is undoubtedly true though it remains to be seen if the main thesis argued here - that teaching and learning of key skills including literacy and communication, mathematics and science can be enhanced by strategies that take aesthetic factors into account - might gain countenance with educators, programme managers, college heads and school headmasters, training and lead bodies, awarding and examining bodies, and any others responsible for devising and delivering programmes of learning and, hence, the destiny of education.

We, humankind, sense the 'beautiful' in numerous ways in the delightful, joyful, exciting, thrilling, puzzling and amazing aspects of life, and in things that are especially pleasing to our senses as well as to our feelings and emotions. Such affective, aesthetic pursuits and emotional experience are

commonplace in children's learning and the early years curriculum is pleasurable for each child as individual interests are developed. There is time for the asking and answering of questions, and participation in activities that are creative, engaging the senses and imagination. The early learning curriculum is fairly evenly balanced , but as youngsters progress through school more emphasis appears to be placed on cognitive functions as they seem to command more preference and higher value. The balancing of 'academic', disciplines with the more affective pursuits become difficult in an ethos of 'academic' schooling where the system values only intellectual skills and 'academic' passes. Many young learners can become victims of 'failure' early on in their lives as a result of not achieving academically although many of them may have had the potential to do so. Such experiences tend to have disastrous effects on young people, having to nurse and tend themselves of its wounds for the rest of their lives. Even when they return in later years to amend their non-achievement, the psychological aspects and pathos of earlier failure cruelly haunts them as recalled by many a second chance learner and adult returner.

For the young, the experience of participating in after-school clubs of extended curriculum or extra curricular programmes consisting of games and physical recreation, performing arts projects, science clubs and other creative activities such as storytelling and nature walks, have had an appreciable impact on some children's learning behaviour and social well-being. Such events whilst relieving some disaffected youngsters have tended successfully to motivate learners who had previously lost their enthusiasm for lessons. The programmes have had the capacity to provide aesthetic and affective appeal and experience such that they might heal, calm, counsel , delight, instruct and point the wayward young in the right direction, thus reviving their natural pleasure for learning and for play behaviour, the latter activity aiding the former. Examination of the aesthetic and affective aspects that contribute to how children and young people are effectively instructed have considerable significance for two reasons: one, genuine natural learning - to come to know about things - is itself pleasurable and continuous, and may aid one's self-esteem, and two, that feelings and emotions are part of the personality and have an effect on intellectual behaviour and performance. Learning institutions, schools and classrooms might take account of these qualities and abilities so as to nurture them foremost in the service of learning.

An educational system which measures predominantly written academic skills and neglects the 'feelings' side, the affective dimension, is denying the presence of abilities, knowledge, skills and capacities that might be present and, thus actively operating outside the bounds of written intellectual skills. A true experience of learning and instruction, it may be argued, ought to nurture, develop and utilise the complementary workings of the intellect and intuition, cognitive and affective, in order to offer opportunities of greater fulfilment for each individual.

Aesthetics - its perception and experience - as a vital area in education has not received the attention it deserves. It has belonged to the domain of affective learning which does not lend itself easily to the National Curriculum's currently established assessment criteria, thereby making it less significant than cognitive learning which is conveniently assessed for 'academic' achievement. The 'feelings' side as a major product of humankind's evolution and vital history confers an indispensable value upon human learning , development and survival. Human beings need to develop more fully than they are currently allowed to by a seemingly mechanistic and purely academic system that invariably blanks out the 'feelings' side in the teaching and learning equation.

AESTHETIC CREATIVITY IN HISTORY: THE CASE OF THE ELIZABETHAN OR ENGLISH RENAISSANCE *(1580-1605)*

In the vital history of humankind, recognizing, creating and enjoying the beautiful occupied a characteristic place. At certain times in history individuals in small and large groups of poets, artists and thinkers of utterly original creativity have taken to themselves a body of conceptions and

practices that possessed magical qualities - uniquely creative powers - that earned them the status of classical works and achievement. For instance, epic poets have either had immediate access to an oral tradition, or have reached out to the human and natural sciences for an appropriate ontological conception of their work and thus rediscovering a 'classicism' of their own. Among these the following poets may be placed in a series: Homer, Virgil, Dante , Milton. Whole groups of writers, dramatists, philosophers, artists and scientists have sometimes arisen, energized by kinds of classical principles. The paradigm case for Western cultural tradition is obviously classical Athens of ancient Greece, but there can be identified other remarkable periods of extraordinary creativity such as the neo-Classical Latin period culminating in Augustan Rome, the Florentine Renaissance which spread from Florence to Venice and Rome later, the periods of French and Spanish Renaissance, the Elizabethan English Renaissance in late-sixteenth century and the American Transcendalist or Renaissance period in New England in mid-19th century.

The Renaissance civilization of Europe had experienced the effects of the New Learning for at least a hundred years before England, and it certainly was the War of the Roses that held her up from progressing in terms of both artistic creativity and religious and philosophical autonomy. During the latter end of Elizabeth's reign, England had achieved a remarkable success in terms of originality and standing in the creative arts, in science and technical know-how, in statesmanship and seafaring, and in the sphere of religion and philosophy. It was the time of Shakespeare and Marlowe, of Sidney and Spenser, of Walter Raleigh, Francis Bacon, John Donne, Ben Jonson, Nicholas Hilliyard, Thomas Hariot and a whole phalanx of writers, thinkers, poets, dramatists and navigators. The drama of Shakespeare, the prose of Marlowe and Raleigh, the verse of Sidney and Spenser, the theatre of Ben Jonson, the triumphs at sea and the independence from Rome in their religious and philoopshical activity brought a new energy to bear. The science and technical know-how were locked in the mystique of levers, fulcrums, pulleys and quadrants, But, the Age of Elizabeth besides acceding to the Act of Supremacy that saw the rise of a modern nation-state also began to see the emergence of a new language - modern English, signalled not the least by Sidney's sonnets (fashioned after Petrach's sonnet sequence *Stella*) and Spenser's allegorical epic "The Fairie Queen" (matching the splendour of Ariosto's *Orlando Furioso*). There were some advanced and significant scientific ideas that were being fostered at this time: speculation on the nature of light, astronomy observations of the craters of the moon using the 'perspective truncke' - the precursor to the modern telescope, the phlogiston/oxygen controversy, and the seeds of atomic theory, even quantum theory and relativity, were engendered into the womb of modern science to come by the great philosophical debates *Ex nihilio nihil fit* - the idea of "Creation out of Nothing".

The Renaissance civilization, like the creative periods before it, had recognized the fluidity of their creativity. One observation was that the three Renaissance themes that underpinned both their natural and classical activity were: 1) The Idea of Art as a continuation of Nature's own innovative tradition, 2) on the question 'what kind of universe can be created by verbal fiat' ? 3) on the essentially interdisciplinary character of the creative process. For the first theme, Sidney, Shakespeare, Raleigh, Spenser, Marlowe and others espoused the view that the artistic imagination was a second poetic world alongside the poetic world of nature. For them, the artistic imagination was a divine gift inherited from before the fall from grace, and the powers by which humankind share in the work of the Creator were supremely natural to them. The imagination gave these poets immense scope for creativity far more than did natural objects, yet the Renaissance did not present the artistic imagination as divorced from the world of natural science and the sciences of man, but rather as their culmination and purpose. Shakespeare was clearly influenced by this Renaissance Elizabethan view when he writes in his *Midsummer Night's Dream*,

> The poet's eye, in a fine frenzy rolling
> Doth glance from heaven to earth, from earth to heaven,
> And as imagination bodies forth
> The forms of things unknown, the poet's pen
> Turns them to shapes, and gives to airy nothing
> A local habitation and a name

The second theme (what kind of universe can be created by verbal fiat?) finds its apothesis in the word art culture of the late-Elizabethans. The generalization of the lever idea saw the concept applied to all technical endeavours like surveying, chronometry, lifting by pulleys, architecture, navigation. It also leant itself to language: the fulcrum was the trope of the transforming leverage of metaphorical language It relates a parallax idea - a kind of mental leverage - that with the right combination of words as the fulcrum the world may be balanced across the lever and transformed, even colonized. Other arguments extended the idea that the world itself was a conventional reality, like a spoken word., a fiat. The world was like language, a self-validating, self-maintaining, conventional reality - one might say language *is* it. In a society of rich drama, prose and verse, theatre, magnificent gesture and rhetoric - magnificent descendents of the oral tradition - the art of words, literary art, words and metaphor played a dynamic role in securing the truth. And the act of translation seen in that view was not merely an act of epistemology but also of ontology..

The third theme - the essentially interdisciplinary nature of the creative process - held true for all Renaissance Elizabethans. That was the last moment in Western culture when the matter of science and the matter of arts and humanities could be considered the same. For Shakespeare, "art" meant craft, philosophical knowledge, technical power, science, liberal education, technology, magic, theatrical sleight of hand and art, in the modern sense, all rolled into one. The destruction of the coherence of knowledge may be traced and epitomised in the etymological collapse of the the word "art". Shakespeare's *The Tempest* completed in 1611, being the last moment in the West of full cultural health - Prospero, its hero taking on the multidisciplinary roles of philosopher-priest-magician -scientist-artist - thus unifying the disciplines, and it is Prospero's "art" that makes temporary sense of the 'airy nothings' the world is made of, rendering it into 'cloud-capped towers and gorgeous palaces, solemn temples, even the great Globe theatre itself. In the decades of the new revolutions that followed the word "art" was gradually torn to shreds, until in our time now art and science, science and philosophy, art and philosophy, science and technology, magic and science, craft and art, education and art, have all been set against each other.

AESTHETIC PLEASURE OF BEAUTY: SOME RECENT DEVELOPMENTS

A thing of beauty is a joy forever

\- John Keats

Beyond the 'Two Cultures'

The traditional and modernist views of art and beauty is that since they belong within the sphere of Geisteswcissenschaft - spiritual or mental knowledge - they cannot be studied within the realm of Naturwissenschaft - natural or scientific knowledge. The Platonic, Cartesian and Kantian division of the world into mental and physical still held true for C.P.Snow's *Two Cultures* (Snow 1959) whose heyday was the Cambridge intellectual culture of the post World War II years with most artists and scientists agreeing on the separation. Most artists, writers and poets (T.S.Eliot, D.H.Lawrence, F.R.Leavis) maintaining that their work was too lofty to be sullied by the materialistic, mechanistic and deterministic physical world fostered by science, scientists maintaining that the arts were a trivial fantasy useful only for the passing of leisure time. Many an artist knew better and had inspired thoughts transcending the science versus the arts/humanities dichotomy (Menuhin 1960).

However, this traditional and modernist picture has undergone a profound change, due to emerging epistemological paradigms generated by interdisciplinary co-operation. The new worldview sees science as a search for elegance, coherence and beauty (Bronowski 1976, Mndelbrot 1983, Davies 1983). The new scientific outlook has also allowed justification to renew the great Classical and

Renaissance project of the scientific study of aesthetics as recorded by new developments (Werner Reimers 1983, Turner F 1985, Epstein et al 1988).

The study of beauty, however, inspite of all these developments in the 1990s is still a very controversial area to reckon with. Aesthetics due to the unclearness of its usage is a vexed subject. Especially when artists and aestheticians themselves seemed to have abandoned the very idea of beauty though the long cherished goal and meaning of art is beauty itself (Ogden & Richards 1923). There is no established discipline as at present that incorporates the systematic and scientific study of beauty. Even if there had been one that however directly or indirectly dealt with aesthetics, its boundaries would still be unclear and subject to progressive redefinition. As a body of research and knowledge, it would possess as yet no institutions, libraries, training and lead bodies, and examining and awarding organizations.

The seminal ethological / natural behavioural thesis of the *Umwelt* described in detail below, proposes that the world of a living being is circumscribed by the capacities of its receptors and affectors (von Uexkull 1921). For the foraging bee, then, such qualities as variety, symmetry, colour, harmony, precise detail, redundancy of pattern, complexity in simplicity, unity and even accurate mimicry are clearly part of the bee's world. These qualities, especially when brought together , are equally clearly involved in human visual aesthetics (Eibl-Eibesfeldt 1970). David Attenborough's nonchalant off-hand remarks in his natural history series *Life on Earth* that flowers were designed to attract bees by appealing to their aesthetic taste (Attenborough 1979)went almost unnoticed by the detractors of the notion of beauty.

Mainstream philosophy has argued that beauty is in the eye of the beholder, an eye preconditioned by social convention and economic interest. Such an assertion might be true for what is 'beautiful' may be utilitarian or instrumental or, indeed culturally conditioned. The objection is that the aesthetic is essentially "for its own sake" and cannot be utilitarian in purpose: the whole existence of the bee is in an adaptive sense "for its own sake" anyway. The distinction between the utilitarian and the intrinsically valuable might begin to disappear if the qualities comprising of beauty were to be recognized as necessary to and even constitutive of the continued survival through the passage of time, in the midst of affecting other processes, by circumventing the entropic decay of organized physical structures of the physical and material world (Thorpe 1976, Turner F 1985).

In the last decade aesthetics has been the chosen arena for some of the most original thinkers with some exciting and extraordinary insights. As the subject matter is controversial, many of the workers in the field tend to take themselves on to the safe confines of the interface between the traditional humane study of society and the traditionally "hard science" study of living organisms. Any systematic basis for the study of aesthetic phenomena might take the main pathway through biology, for the perception of beauty is first and foremost a capacity possessed by living organisms, one which must have been selected for, and genetically preserved, by biological evolution.

The new thinkers and investigators do not stop there, they make interesting claims about the objective characteristics of beauty in the physical universe, and the fundamental strategies of physical morphogenesis and survival. Indeed, the human cortical information processing system as understood currently by neuroanatomical and neuropsychological developments, claim that the brain is "kalogenetic" (Greek; *kalos – beauty, genetic = begetting*), seeking, recognizing, creating and affirming 'the beautiful'. These claims have initiated a fresh impetus into the reappraisal and investigation of our humanistic understanding of beauty. This development has rescued the study of beauty, the discipline of aesthetics, from being 'frozen' on the bookshelves of academic philosophy. Just as epistemological and technological advance generated new paradigms for learning, as in demography which breathed new life into the study of human populations, bringing to it a dynamic three-dimensional clarity which was not there before, the examination and analysis of aesthetic perception have benefited greatly from the interdisciplinary insights and advances of many workers.

The sciences, the arts and religious practices of civilized humankind lie at the roots of the rituals of their Homo erectus and Homo sapiens ancestors (Turner V W 1968, 1969, Schechner 1977). Although this might be the outlook of many in the sciences, exponents of other fields are not so sanguine. Analyses and perspectives of aesthetics based on models of human evolution have been roundly rejected or at best firmly resisted. For instance, within literary studies very little theory exists that explores either the basis or purpose of literature from biological or evolutionary perspectives. Nancy Easterlin working on the aesthetics of literary art believes that "thinkers as removed from one another in time and philosophical perspective as Aristotle and Shelley have suggested that the sense of beauty in art develops out of and strengthens the basic nature of human experience. Those in the 20th century who have brought a contemporary scientific perspective to literary theory are few and far between. Theory, like epistemology, has successfully resisted evolutionary approaches to it, remaining firmly ensconced in an outdated methodological dualism and the abstract methods of the Western philosophical tradition" (Easterlin 1995).
Humankind see, hear, (also taste, smell, touch) the beautiful and seem to recognize it with an intuition and a pleasure that is utterly natural. The 'natural intuition' to enjoy the aesthetic pleasure of beauty is, for us, activated, sensitized, and deepened by culture; that is, a natural capacity of the human nervous system is enabled to incorporate a cultural feedback loop, and uses also the physical world through art and science as part of its own hardware. Such a conceptual framework on aesthetics, implicit in the paradigm of "natural classicism", described below, is based upon the co-evolution of the biological (genetic) and cultural (psycho-social) developmental elements of the human nervous system. If the evolution of our sense of beauty is a non-linear feedback between cultural and biological determinants, recent developments in chaos theory, non-linear processes, self-organizing systems can point the way to a better understanding of aesthetics. Indeed, a broader re-definition of beauty is what is postulated, as an objective property of the fundamental generative processes of the universe - and thus as possessing a real, not just a subjective, arbitrary existence. Like the eyes, our aesthetic sense has been designed by our evolutionary development to perceive something that is really out there.

The term aesthetics as implied in this dissertation will apply less to the 'aesthetics' of academic philosophy and rather more to the emerging theoretical frameworks in aesthetics, the perception of the 'beautiful', as explored by anthropology, ethology, Renaissance studies, neuroscience and psychology in the last two decades. A consideration of a new paradigm for aesthetics and a systematic study of beauty requires models of interdisciplinary learning. The new aesthetical theories then become applicable to the whole spectrum of the arts, the sciences and the humanities. Some of the most fertile theoretical resources which are informing the new interdisciplinary perspectives of aesthetics will now be considered.

The Paradigm of "Natural Classicism"

William Shakespeare..... for me.... is the greatest Natural Classicist of all
- Frederick Turner (1985)

"Natural Classicism" is an interdisciplinary conception of the evolutionary bridge that attempts to span the divide of nature and (classical) culture and thus, of natural creation and human (cultural) creation. The paradigm is the synthesis and interpretation of cultural anthropologist Victor Turner, whose seminal work on the significance of human ritual and the ritual process has had considerable impact on the study of beauty (Turner V W 1969, 1974), and referred to later - and the Renaissance scholar and poet Frederick Turner, whose groundbreaking work on beauty and the values of beauty have been very influential (for instance, the work of Committee 4 at this conference, which is in turn a continuation of a study group on aesthetics at the previous ICUS meeting in 1995 has largely been due to his seminal work in the humanities and other transdisciplinary areas) and matched only by the brilliance of his joint investigations with Ernst Poppel, on poetic meter and the 'neural lyre' approaches to verbal and linguistic art.

Natural Classicism is an acid test for the philosophical assumptions of the reader. It may even be a paradox for some. The diehard lover of classical high culture may value precisely that about the classic which transcends and defies nature. The romantic lover of nature, on the other hand, might well boggle at the implication that nature, innocent, free and spontaneous as it is, could ever endorse let alone produce so sophisticated, restrictive, and artificial a notion as classicism. Natural Classicism is an invitation for both outlooks to change their conceptions radically. Classicists and students of the Renaissance, educated in the Aristotelian, Florentine neoplatonist or Thomist (after St Thomas Aquinas) tradition might interpret "natural" as pertaining to natural law and might find nothing remarkable in the title: the classical, in the sense of the excellent, ought to follow nature. Such readers may, however, find just as deep, if more subtle, a difference in worldview. The "nature" that "natural classicism" is interpreting is not the nature of Aristotle, Aquinas or even the Florentine neoplatonists. Rather, it is nature as we have come to know it through late twentieth-century science: a nature which may indeed possess and exhibit all those values which were once attributed to it, but which must do so within the constraints of mechanisms and processes that can be strictly described in empirical language and reproduced under laboratory conditions.

Natural Classicism, whose roots lie in the evolutionary perspective, entails two claims about beauty. The first is that our capacity to perceive and create beauty is the characteristic of a species that evolved. Beauty is, thus, in a way, a biological adaptation in addition to being a physiological reality: the experience of beauty can be connected to intricate processes of neurochemistry and neuroanatomy in the brain itself. Beauty has a central place in the interplay of biological and cultural evolution that were to produce the eventual flowering of Homo sapiens. The capacity for recognizing and creating beauty is a competence that we possess, a competence that was selected for by biocultural co-evolution. The results of this co-evolution in the neurobiology of aesthetics are manifold. Humankind has inherited a number of Natural Classical" genres or systems by which we generate, recognize and appreciate beauty (Turner F 1995). One of these, poetic meter, has been investigated by neurophysiologist Ernst Poppel and his colleagues. His seminal paper with Frederick Turner on the "neural lyre" approach to the brain (Poppel & Turner 1983), informed the role of auditory perception and the whole spectrum of aesthetics in verbal and linguistic art that the auditory mode generates, e.g., rhythmic driving, narrative, meter, mnemonics, and other psychic and dramatic technologies. The astonishing finding that poetic meter is universally three (2.5 ~ 3.5) seconds in line-length, and that this was tuned to the human brain's universal three-second acoustic information processing pulse was a revelation that had far reaching implications for verbal and linguistic arts. Psychic and dramatic technology like metered poetry are arts of the oral tradition used effectively by the most ancient civilizations for dynamic communications and as sources of wisdom (O'Brien et al 1986, Epstein et al 1988).

The second claim about beauty is linked to the "oceanic feeling" a la Arthur Koestler, of philosophical insight that is sometimes associated with beauty, and would incorporate the beauty that is found in nature and in the laws of science. If beauty is a real characteristic of the universe, one that would be useful - adaptive - to know, then whole species must benefit from possessing a sense of beauty - thus going beyond the understanding of a species-specific sense of beauty (as the evolutionary perspective would have it) as being possessed by individuals within a species in relation to co-operation and sexual selection. This general evolutionary truth proposes that the experience of beauty is the recognition of the deepest tendency of the universe. This tendency cannot however yet be understood, but is a matter for the future and for the way science is unfolding more information about our astonishing and mysterious universe.

The perspective suggests that we may no longer look at human cultural activity, especially the very ancient kind like oral performance and artistic ritual as simply arbitrary in form and structure. There may be real artistic rules to be discovered just as the classical critics maintained (though for different reasons). Frederick Turner agrees that, 'our brains and bodies will be happy, facile, vigorous and inventive' - radiant and porous, as Virginia Woolf once put it - 'when we use one kind of artistic

structure and not when we use another kind'. We relate, and respond warmly to, a kind of plot or story than to utterances that do not make some story; babies prefer nursery rhymes to other kinds of sounds (Glenn & Cunningham 1983) and we are better at reciting three-second chunks of language than eight-second chunks. Natural Classicism predicts that there should be a science of beauty and that it may offer powerful solutions to problems in artistic and humanistic disciplines as well as to other fields. It also spells out a great promise for our species of an emerging classicism - a Renaissance - not just of the arts but of the whole spectrum of learning. This resurgence will be based upon the deep lexicon and syntax of human artistic nature as it is being uncovered. The richly generative aspect may be likened to Chomsky's linguistics: Chomsky saw language as a relatively small group of connected laws which, however, had the extraordinary capacity to generate an unlimited and unpredictable repertoire of expressive utterances (Chomsky 1975). In the generative qualities of the deep lexicon and syntax of human inheritance, the classical arts can be seen as a descendent of ancient ritual practices where it would be possible to find under the diversity of cultural richness and variety, a universal human "grammar" of aesthetics, tuned to the self-reward system, the reflexive system, the information processing pulse and other constraints of the human nervous system as discussed below.

Psycholinguistics of colour vision

Heinrich Zollinger, the distinguished Swiss chemist, working in the psycholinguistics of colour vision has been a pioneer explorer in uncovering the variety of aesthetic appreciation and perception. He claims that experimental studies of the neurophysiology and psychophysics of our visual and auditory senses have contributed to a broader and deeper understanding of art and aesthetic perception. Zollinger also identifies that the human brain function is based on an aesthetic framework of reference - a sort of 'neural lyre' in acoustic terms - outlined below in *Cortical information processing system*, that is inherent in our scientific urge to confirm and affirm a given hypothesis, rather than to deconfirm it (refutation, as Karl Popper would have us do). He writes: "For the ancient Greeks aesthetics (aisthesis) meant perception or sensory experience in general. For Kant, human perception is a passive gathering of sensory data, whereas aesthetics is the active and subjective evaluation of sensory data.....an increasing number of cross-disciplinary investigations demonstrated that perception (normal sense perception) and aesthetics (aesthetic perception) are not separated by an unbridgeable divide, but seem to be closely related to each other, and lying along a continuum of sensory levels of increasing complexity" (Zollinger 1979 p 279). The continuum of sensory levels to the highest level which is that of aesthetic perception as indicated in the sketch;

Aesthetic perception
↑
Normal (ordinary) sense perception
↑
Sensation
↑
Physical impact

The way that aesthetic perception works is that it has a greater and distinctive awareness than normal or ordinary perception, just as normal perception has over sensation, and sensation over mere physical impact. Aesthetic perception is as much more constructive, as much more generous to the outside world, as much more holistic, and as much more exact and particularizing than ordinary perception, as ordinary perception is than sensation. This is also indicative of the way the universe seems to be working and underpins a deep tendency - the deepest tendency or theme (leitmotif) of the universe. Some of these themes discovered mainly through the natural sciences are;

unity in diversity/multiplicity (the universe is a unity in spite of its enormous variety and quantity)

complexity within simplicity (generated by simple physical laws such as those of thermodynamics)

generativeness & creativity (creates genuine novelty moment by moment like the laws of chemistry)

rhythmicity (it is the home of an innumerable hierarchy and scale of vibrations)

symmetry (as in patterns of the universe everywhere)

self-similarity (as displayed in the 'true' or fractal geometry of nature

The ethological/natural behavioural thesis of the Umwelt

The term *Umwelt* may be explored by considering a reply to the question: What activity can be much more important than nourishment and reproduction ? An answer to the question and an understanding of the *Umwelt* lies in the way behaviour and perception of living beings may be described.

Every living thing enters the world with a specific genetic endowment and with certain inherited expectations which are tested by the senses during the course of development. If the expectations, the internal models, are deconfirmed by sensory experience, the models are reconstructed, however painfully, so as to reconcile with every day experience. Vilmos Csanyi addressing the biological function of the brain says: "Mind and cognition are inseparable from the structure and function of the brain. There appears to be a consensus among those who analyze the brain, that beside many regulatory roles, the main function of the brain is to make representations (internal models) of the outside world (external conditions)" (Csanyi 1991).

Living things have a species-specific world, a set of relevant factors in its environment which its receptors - its senses - are designed to detect and its affectors - its limbs and other active organs - to act upon. Outside that world, that *Umwelt*, nothing exists as far as that living organism is concerned. For instance visual phenomena have no existence for an eye less species. For species with simpler nervous systems the *Umwelt* is a crude one containing only a few unrelated elements: there is a fairly direct link between stimulus and action without much intermediate interpretation of the various sensory inputs. For advanced species, on the other hand, with a much higher ration of nervous tissue to body weight and complex cortical development, the evidence from many receptors is continuously integrated into a coherent universe of enduring objects in motion relative to each other and to the organism that perceives them.

Physics was once described by Jacob Bronowski as the "immortal scientific achievement of the 20th century, the human imagination working communally has produced no monuments to equal it - not the pyramids, not the Iliad, not the ballads, not the cathedrals " (Bronowski 1976). Even such a marvellous discipline as physics might not be able to, with its plethora of concepts, laws, principles and paradigms, account for anywhere that entities as enduring objects exist. As far as can be surmised from studies of perception, enduring objects come into existence as the highly elegant constructs of the brains of higher animals. Physics, the ingenious discipline that we know it to be, might know only a complex interplay of the fundamental forces at their various intensities, wavelengths, and vectors. The concrete universe of objects as we, the higher species of living beings know it, is the most ordered, coherent, powerful, parsimonious and comprehensive hypothesis that will reconcile our inherited expectations with our experience. Before a species can feed itself or even reproduce, it must enter into a consistent working relationship with its world, its Umwelt, which will generate predictions to be

confirmed or deconfirmed by experience. Such a relationship is harder to maintain the more information an organism is capable of absorbing and the more it is capable of doing; and the human brain, it is informed, uses about one-third of the body's oxygen and nutrients. World constructing cosmogenetic activity is provided with a powerful inducement and motivation, and is hard work, and must be richly rewarded.

Cosmogenesis or cosmogenetic, or world creating, activity, known to be a poetic process of internal world modelling, or even alternate world construction, is a function that is fundamentally sponsored by the perception, recognition, creation and appreciation of beauty. Beauty is at the heart of generating what anthropologists, ecologists and ethologists have referred to as the Umwelt in the special sense that the term was first used by pioneer ethologist Jacob von Uexkull (von Uexkull 1921). It is the concrete universe of objects as we have come to know it, and is the most ordered, coherent, elegant, parsimonious,, powerful and comprehensive hypothesis that will reconcile our inherited expectations with our experience. In Frederick Turner's words: 'It follows that when we hear words like "beautiful", "ordered", "coherent", "elegant", "parsimonious", "comprehensive", we are already in aesthetic territory' (Turner F 1985 p 6). The activity of world construction is for humankind much more vital, much more difficult, and much more highly rewarded than it is among other species whose Umwelt is relatively more inherent in their genes. Thus the tradition of oral performance - which lies towards the artistic end of the ritual spectrum - may be much more closely tied to human survival as a species than we are able to recognize, since it is the human experience, as it is the human specialization to create worlds to be tested against sensory experience, as it is the mole's to dig and the bird's to fly.

In pedagogy and learning reading, Sylvia Ashton-Warner conception of 'organic' reading approaches spell out a profound conception of children's early development of learning about the world (which can be likened to world model construction and Umwelt learning), and about learning words and developing reading. Ashton-Warner's experience with children who have been calmed and soothed, is described in her own experience and words:

> *"First words must have intense meaning for a child"*
> *"First words must already be part of the dynamic life"*
> *"First words must be made of the stuff of the child"*

She seeks a movement with an unbroken beginning within the dynamic material, within the familiarity and security of the child (Ashton-Warner 1980): this is a gracious movement from the organic to the inorganic, and then to outer reaches. This organic learning, or reading, is part of the natural expansion of life and to be counted among the stars

Cortical/Neural information processing system

In the context of classroom learning the visual and auditory pathways come to the fore: seeing and hearing is constitutive of the central nervous system in relation to the senses of taste, smell and touch which make up the peripheral system. In cortical/neural information processing for visual and acoustic activity, *rhythmicity* is one of the brain's key characteristics and can be "driven" as in rhythmic driving or metered verse, or reinforced by repeated photic or auditory stimuli, to produce peculiar subjective states. The system is also *self-rewarding*, which means that the brain rewards itself for certain activities which are presumably preferred for their adaptive utility. If this system of reward is the major motivating agent of the brain, any technique for calibrating and controlling it would result in an enormously enhanced mental efficiency. It would be possible for us human beings, the, to harness all our intellectual and emotional resources to a given task. Many investigators have argued that this is exactly what an aesthetic education, including an early introduction to nursery rhymes and metered verse, can do (Poppel 1983). Many workers in the field are of the opinion that the autonomous and

reflexive reward system which underlies the whole realm of human values, ultimate purposes, and ideals such as truth, beauty and goodness (Turner F 1985 p 68).

Cortical information processing, associated with the brain's capacity for self-reward is characteristically *reflexive*. It is within broad limits *self-calibrating*, partly in keeping with the brain's tendency to ignore repeated and expected stimuli, and to respond only to the new and unexpected. The system is also essentially *social*, for not only specific skills and communicative competencies are learned in a social context, but also the fundamental capacities of arousal, orientation, attention and motivation. Another characteristic of the system is that it is *hemispherically specialised*, that is, having an asymmetry in terms of the left side of the brain and its right. Jerry Levy characterises the relationship between right and left as a complementarity of cognitive capacities (Levy 1984). The significance of cerebral asymmetry and inter-hemispheric collaboration for learning is discussed later. The cortical information processing is *kalogenetic*, identified in the human scientific urge to confirm and affirm a given hypothethis (Zollinger 1979), and has a strong drive to construct affirmative, plausible, coherent, consistent, parsimonious and predictively powerful models of the world in which all events are explained by and take their place in a system which is at once rich in implications beyond the existing data. At the same time this should be governed by as few principles or axioms as possible. The words used by scientists for such a system are "elegant, powerful, beautiful"; artists and philosophers use the same terms and also "appropriate, fitting, correct, and right".

Neuropsychological considerations

Neuropsychologists postulate that there are internally generated brain rewards, the pleasure chemicals (Olds 1976), that are more powerful by many orders of magnitude than the psychologists' conventional motivators. The "higher pleasures" of creative mental effort, of beauty, of goodness, of truth are indeed independent pleasures, having their own physiological basis and (Pribram 1969), and not merely perverted or sublimated versions of sexual or nourishment drives as previously proposed by the theorists of materialism and behaviourism. The endorphins, as the endogenous brain chemicals are called, are clearly involved in aesthetic pleasure. At this stage, two key questions are: What is the adaptive significance of aesthetic pleasure? Why should human beings be designed to appreciate beauty and to enjoy it with an intensity which is potentially much greater than that of hunger or lust? Work carried out by endocrinology and neurochemistry claim that human beings are genetically programmed to risk potentially damaging stress in order to perceive or create the beautiful (Willer et al 1981). Why should this be so? We seem to encounter a mysterious connection between beauty and survival, and thus between beauty and being itself. The qualities that comprise beauty are necessary to an even constitutive of the continued survival in time and against entropic decay (Wilson 1980).

The pleasures that "pleasure chemicals" administer, appear to be associated with the autonomy, the power over the future, and the predictive capacities of the organism. A definition proposed by Frederick Turner of the aesthetic pleasure of beauty is "....the sense of beauty is not the same as the exultation of power though it can resemble it. Beauty is associated with a certain set of perceived objects, and with a certain manner of perception, cognition and emotional comprehension, but not necessarily with action as such; some of the strongest experiences of beauty take place in response to our own endogenous imagery of dream, fantasy or memory. The feeling of beauty, then, is a reward for a certain autonomous activity of the brain, one which gives the brain a grip on the future which is, however, not necessarily involved with immediate external actions to change the environment (Turner F 1985 p.14-15).

Human beings are rewarded powerfully by the pleasures of taste and sex, for the metabolically expensive activities of foraging and reproducing themselves. However, it has been seen that the appreciation and creation of beauty is much more metabolically expensive, and is to be rewarded by a pleasure which is correspondingly greater than the delights of sex and eating. The question may be

asked: What activity can be more important than nourishment and reproduction? The answer to this is in understanding the *Umwelt*.

Neuropsychologists Jerre Levy and Lauren Harris have attempted to divide the components of aesthetic experience (seeking, recognising, perceiving, appreciating) and production (create, make, produce, realise) arriving at three broad categories. These are: 1. Sensory-Perceptual. 2. Emotional-Affective and 3. Motor-Executive (Levy and Harris 1995). In the sensory-perceptual category the aesthetic experience emerges from certain processes of the mind applied to certain qualities of the environment or external world. A basic question is, what are the qualities of the external world that the mind represents? In terms of the visual arts the qualities are those contained within the picture frame - colours, forms, or both, and the variations within these dimensions. In the case of colour the variations would be in hue, brightness and saturation. Variation in form include length, width, curvature, orientation, texture, and 'depth' of surface, as a second order of dimension. For the sense of hearing, the aesthetics of a song, poem or verse are governed by qualities like rhythm, tempo, timbre, tone, sound texture and so on. The eventual reward for the recognition and appreciation of beauty in this category can be one of deep emotional stimulation. In the sciences as well, those theories that self consistently and harmoniously account for a large number of phenomena, are favoured and regarded as beautiful. On the emotional- affective category it is meant that in every aesthetically pleasing work of art there is some quality that moves us emotionally, that engages our feelings. This category is understood as one where the aesthetic quality moves us in our heart and not just our head. Both sensory-perceptual and emotional-affective categories comprise the 'input' from the external world; they are all that can be contained within the picture frame or other suitable parameter. The motor-executive is the production/creation category, for the artist, of course, needs the physical skills to express these components on to the canvass. This category, motor-executive or 'output' is the one that most clearly defines the artist. Many people may be able to imagine beautiful scenes or to create them in their dreams, but only as fortunate few can construct these scenes on a canvass or in some other medium.

Work of Werner Reimers Foundation in the 1980s

Studies of the biological foundations of aesthetics, the sense of beauty, was fostered by the Werner Reimers Foundation based in North Germany in the early 1980s. They convened scholars and investigators from a number of cross disciplinary perspectives and their work has been revealing. While nature inspires great works of art, the nature that late 20th century science pursues is made equally lovely by its inspired amateurishness in searching for elegance, coherence and beauty. Nature can be a trigger in itself to inspire the scientific enterprise (Davies 1983). The Werner Reimers study concluded by confirming that aesthetic perception lay in a continuum from mere physical impact through sensation through ordinary sense perception to aesthetic perception. The insight that was disseminated was that aesthetic perception was correspondingly more exactly truthful about the nature of the universe than was ordinary sense perception (Epstein et al 1988).

The major point that emerged from discussion of the biological foundations of aesthetics is that there are certain implications that follow about the nature of the physical universe. Either it passively submits itself to the imposition of aesthetic pattern by the higher organisms thus encouraging their survival, or else it contains inherently those very laws themselves, so that "aesthetic predictions" of its behaviour are adaptively justified by their objective correctness. These two alternatives may in fact be different ways of stating the same principle. Various lines of research have suggested that the production of exquisite patterns may be an inherent property not only of matter, but of mathematical probability itself. According to this view, the universe does not merely produce occasional ordered patterns, but rather it cannot help actively and preferentially generating beautiful kinds of shapes in space and time. An impressive array of works in the realm of physical sciences - quantum physics, non-linear feedback processes, fractal geometry, quantum cosmology (Finkelstein 1982, Feigenbaum

1980, Eigen and Winkler 1981, Mandelbrot 1983) - have demonstrated that the universe is an active generator of order as much as the universe, in the traditional notion, is a passive selector or reflector of it.

Psychic Technology and Bonnes a Penser

Clarified by the function of neural information processing and recognised in periods of extraordinary artistic creativity, psychic technology (techniques of narrative, rhythm, meter, mnemonics and other forms of effective communication and facilitation) is a legacy from the oral tradition. Its considerable influence in contemporary literacy is not disputed. Equally, words and metaphor are active ingredients of everyday discourse, and their power to shape our expression need to be taken into account in literacy learning (Goddard 1996). In the interplay of the three ingredients psychic technology, imagination, and orality (word power), Kieran Egan (who prefers the term Bonnes a Penser to technology due to the latter's aggressive flavour) refers to psychic technology as that which stimulates, in a sense brought into being, the imagination, that ability to be moved by, to behave as though one perceives and is affected by, what is actually not present or real. He says "we live in a world of nature, but have invented techniques developed over uncounted millennia for stimulating a vivid mental life that draws members of a society together by strong affective bonds. For children in our society, too, these techniques create mental worlds distinct from the natural world around us, mental worlds charged with vividness and emotional intensity. It is a world that generally gives delight and hurts not, and that can enrich our interactions with the world of nature" (Egan 1988 p.117).

In children's spontaneous play as in their imaginative exercises, as in reading and storytelling (Barrs and Thomas 1991) and games, they use these techniques to create a secondary world. One that John Huizinga calls ".... a second poetic world alongside the world of nature" (Huizinga 1949 p.23). Philip Sidney, William Shakespeare and the English Renaissance poets espoused this view and acted upon it.

However, some philosophers and aestheticians argue persuasively that natural phenomena offer types of aesthetic experience that cannot be provided to the same extent, or even at all, by art and the powers of the imagination. A range of feelings is opened up by nature that the human scene and human culture cannot itself evoke (Hepburn 1984). Other workers claim that we can be more strongly moved, in an affected, emotional sense, by natures beauty than by the beauty of art (Saw 1972). Sir Alister Hardy's seminal research at Oxford, which contributed to a kind of natural history of aesthetic/spiritual experience claimed that the two activities to trigger powerful aesthetic-to-spiritual experience were contemplating natural beauty and listening to beautiful music and (Hardy 1979, 1982).

Perhaps, Margaret Meek's example of the case of the nine year old twins, girl and boy, is a good living example which highlights the interacting influence of three vital ingredients so far discussed: oral tradition through the dynamics of words and metaphor, the inspirational effect of nature and natural beauty, and the power of the imagination. Of the twins the girl had been the achiever, getting the desired result in the standard attainment tasks and other written work, whilst the boy had been a disappointing failure, unable to reach the mark in several assessments until one day when nature walks became the order of the day. On presenting written work following the nature exercise, the girl had written a pleasant piece which made the grade, but, what of the boy, her twin brother, who had so far not shown even a glimmer of hope for achieving the standard? The walks in nature had animated and stimulated him, enabling the poet in him to come out in completing an exquisite piece of verse. In Meek's opinion, and the boy's Head Teacher's as well, the young poet's verse had outstripped his twin sister's achievement which was successful schooled literacy shaped by the National Curriculum Assessment Criteria (Meek 1991). The National Curriculum's machinery could not assess the boy's creativity, nor do justice to his poetry.
To sum up, the aesthetic pleasure of beauty as it is being understood through the emerging framework of theory, is that it evolved as a reward for humankind's single greatest specialisation as a species - the

activity of internal world construction or modelling, or cosmogenesis. Beauty, or the aesthetic capacity, serves an adaptive function. The natural intuition for beauty being activated, sensitised and deepened by culture. Such an aesthetic theory, based upon the co-evolution of biological and cultural elements of the nervous system underpins a deep lexicon and syntax of human artistic nature. This lexicon and syntax does not constrain the system but is richly generative as exemplified by the case of language by Chomsky's work. Given humankind's neural hardware and cultural inheritance, learning context can be better guided by one kind of educational programme rather than another, so as to appeal to our bio-cultural inheritance - indeed our very constitution - which has made homo sapiens what they are. Human ritual, performance and art, embodied by the psychic technologies of "natural classical" genres and other devices, are ways of setting the stage, creating the frame, arranging the Agenda, and picking the topic in such a way as to give human beings a home court advantage in making the ontological contract which is the guarantee of our biocultural evolutionary constitution.

Late 20th Century Science: A search for Elegance, Coherence and Beauty

> **"....the State of exact science where Man is a Machine is no mean city, even though it be the city of a dream. They that have well considered all the dreams of man and yet go often round about her and tell the towers thereof may be pardoned, I believe, if they hold her to be the noblest and the most beautiful of them all"**
>
> - Joseph Needham (1941)

The excellence and the values that were once attributed to nature by the Aristotelians, the Thomists and the Florentine Neoplatonists were never even once found to be true in all of the last two hundred years yet, nature as it has come to be apprehended by contemporary science is of a very difference nature and late 20th Century activity seems to have given increased hope that science can demonstrate that nature exhibits all those qualities that were once ascribed to it.

From perspectives of the history of science it would seem that many of the discoveries of the laws of nature and of the nature of matter, the role of aesthetic perception played a major role. Isaac Newton's passionate love for Euclidean geometry fired him to postulate a universe which became the master work for dealing with motion, momentum, gravity and energy in the physical world, becoming the blueprint for most of the very successful industrial revolution technology (Scorer 1976). Newton's sense of beauty empowering him to keep space flat and Euclidean, making the gravitational attraction inversely proportional to the square of the distance. Another example, though not so clear cut as Newton's, is the perception of Charles Darwin when postulating the hypothesis of evolution by natural selection. It was on the Galapagos Islands, an isolated equatorial ecosystem in the Pacific that Darwin came to see before his very eyes on a dusky afternoon the living evidence for his theory. That this was an overwhelmingly aesthetic experience is without doubt, the beautiful colours of the Galapagos landscape adding extra flavour. But what was extraordinary was that what Darwin thought through for more than 15 years in England before that moment was recapitulated in a moment and the result was that insight placed Darwin on a philosophical escalator from which he could not get off. The aesthetic perception that Darwin experienced on that afternoon was an illustration in natural colour of the hypothesis which he had rehearsed a thousand times perhaps on his armchair in his study at home. Equally, other laws of nature are simple and beautiful such as Avogadro's hypothesise - a law of such unrivalled beauty and simplicity.

Murray Gell-Mann whose discoveries in the realm of sub atomic particles says ".... we concluded that such a theory was not right because it would be ugly. We prepared instead a very beautiful one which contradicted most of the experiments. Now, there is something there that is beside science. In a sense, it is an old idea that hypotheses should be simple. But still it is a slight extension of that idea, it is an essentially aesthetic criterion: that a natural law at a fundamental level must be simple. This does not

apply to biology, but, at the level of elementary particle physics there is a principle about principles, namely that they are simple. There is something to be learnt from that. It keeps happening. On a fundamental level nature expresses herself in a very simple way" (Gell-Mann 1962 p.57). When physicists talk of beauty and symmetry the language through which these concepts are expressed is mathematics. Paul Davies says "it cannot be over stressed how important mathematics is to science in general and physics in particular.....The neurotic fear of mathematics experienced by most ordinary people is chiefly responsible for their estrangement with physical science. It is a barrier that effectively cuts them off from a full appreciation of science and prevents them from enjoying vast areas of nature that have been revealed through painstaking research" (Davies 1983 p.221).

The eminent astronomer Lloyd Motz said "the symmetry of the snowflake, the gem, the spider's web and the honeycomb, of the bird's nest and the flowers of the earth, the sun and the solar system, all evoke our admiration and wonder. Why and how do such macroscopic symmetries arise? Since these symmetries are the properties of the structures, we are naturally led to the consideration of the symmetries of the forces that govern such structures" (Motz 1986).

Beyond the macroscopic symmetries are the microscopic ones whose beauty is breathtakingly simple at the same time they are complex. One unique example is the fractal geometry of nature. From the microstructure of fractals and the coming together of jigsaw puzzle of scientific data, a gigantic cosmic hierarchy has been revealed though its picture is a familiar one as shown below:

biology the microstructure of the human sciences
^
chemistry the microstructure of biology
^
physics the microstructure of chemistry
^
geometry the microstructure of physics

An incentive for learning natural history and biology was David Attenborough's ground breaking work resulting in his *Life on Earth* (1979) and *The Living Planet* (1986). Attenborough's programmes successfully instructing lay audiences on the intricacies of evolution and natural selection was a triumph for visual aesthetics as a major tool of education. Though matters of aesthetics, symmetry and mathematics do not apply to biological sciences, it was the beauty and expressive quality of the language used by the Victorian naturalists among whom were Darwin, Wallace and Huxley, that captivated audiences. A 20th century example was the superb expressiveness in the language of Peter Medawar that enhanced many a student and scholar to be both delighted and instructed. In a reply to the mechanistic notion that a chicken is merely the egg's way of making another egg Medawar says "the only reasonable ground on which one could object to this statement is the pejorative use of the word 'merely', for a chicken is a remarkable and breathtaking way of making another egg, and among birds generally we find other ways of making eggs, always marvellously beautiful and ingenious. It is in such evidence as this - the marvel of the whole symphonic texture of the natural process - that the aesthete/reverent should hope to find evidence of a Great Composer in nature" (Medawar 1978).

RESEARCH IN AESTHETICS, METHODOLOGY AND RESULTS: DISCUSSION AND CONCLUSIONS

There was a paramount need to explore how learners' deepfelt emotion and excitement in perceiving the beautiful, the delightful , the exciting and the thrilling, may be harnessed to enhance the power of the curriculum to engage children in their learning. The lesser needs of the exercise were, first, the development of more effective theoretical frameworks for the emerging paradigm of aesthetics - the

new aesthetics - and second, the devising and use of an effective methodology to investigate aesthetic experience.
An understanding of aesthetics within interdisciplinary models has much to contribute to the organization of teaching and learning experiences, to an understanding disaffection and to an appreciation of how to draw young people in to engage with the curriculum and school experience at a deeper, reasonably significant level. The need of the researcher was to attempt to develop a methodology for gaining access to the learners' personal experiences and to probe the links between their aesthetic experience and school learning. To identify aspects of learners' experience that are imbued with particular experiences of 'the beautiful' and to link them with areas of school learning that they found particularly engaging had a positive value in terms of outcome in this research.

In relation to research on aesthetic experience, many teachers were interviewed in the schools where surveys and observations were made The main aim of this was to assess their bias of curriculum subjects. The accepted dichotomies of the National Curriculum may be set down as;

Mainstream culture		Minority cultures
(Anglo-Saxon/Judaeo Christian)	Vs	(Muslim, Hindu, others)
Male	Vs	Female
Nature	Vs	Culture
Natural Science	Vs	Social Science, Arts and Humanities
Folk (popular) Art	Vs	High Brow Art

Fieldwork Surveys

A random sample of teachers who were interviewed in primary, secondary and tertiary institutions in the greater London area were found to be polarized either towards science or away from it a la "convergers" and "divergers" of C.P.Snow's day. The educational psychologists led by Liam Hudson carried out research on schoolchildren at the age of 12 (Key Stage 3) in the wake of the "Two Cultures" debate then raging over the British intellectual scene. Hudson and his colleagues found out that some were "convergers", having a definite bent on maths and science disciplines and had little or no interest in the humanities or arts disciplines, while others were "divergers" who did have much enthusiasm for arts and humanities though not at all for science (Hudson 1962). The trend set by the schoolchildren of the early 1960s may have been the cause, in the decades that followed, for many a teacher having an unhealthy bias either for science or for arts & humanities, though there seemed to be very few who preferred a balanced view that both areas ought to have equal value and to receive attention. Some of the remarks made by teachers on a survey of the issues were;

1) A English Teacher: (in a Secondary School): "Science at the age of 6 to 12 is overloading the core curriculum. I would prefer them to learn more English and get a more rounded learning experience before going on to science later"

2)A Teacher (in a Primary School): "If children cannot deal with language adequately they cannot do anything successfully; in order to do justice to science learning they need to do more English than they are allowed to do now. They would be doing more of English if science and maths had not squeezed it out".

3)A Science Teacher (In a Tertiary College) "Instead of concentrating on arts and humanities subjects there should be more science. Science is living in the real world, other subjects including social science and educational studies are not dealing with real theses or entities".

Classroom Research and Methodology

Naturalistic observations and in-depth interviews were the main information gathering pathways and considered the most appropriate method for this project. Schoolchildren as a specific group, rather than young undergraduates or adult learners, were considered to be the ideal group for classroom based surveys, interviews and observations. Children's groups and individual children were selected with the assistance of school heads and teachers, and suitable preparations made to introduce them to surveys and interviews over a period of time. The chosen age range was between 6 and 16 years, and a sound balance was achieved in terms of gender, ethnicity and social background as far as it was possible.

From the outset, the task of choosing a methodology to explore pupils' deeply personal experience was fraught with difficulty. Their aesthetic experience which is in their minds, often associated with deep and complex networks of memory would not be simple to put into words. Two previous research projects provided some guidelines. One was a Harvard study of young women's psychological experience (Brown & Gilligan 1992) which made use of anecdotes as a way into deeply personal experience. The other, a study by Oxford zoologist Sir Alister Hardy, was attempting to record individual accounts of how aesthetic-to-spiritual experiences were triggered. Some of the "triggers" had been the contemplation of nature and listening to beautiful music (Hardy 1979, 1982).

The hypothesis that eventually came to be developed was that children might be "triggered" by words chosen for their power to convey affective, emotional and beautiful experiences, From current theoretical frameworks described above, certain words trigger experience and may convey a sense of the aesthetic. This essentially English Renaissance and "natural classical" perspective used in the methodology considered the use of words like 'beautiful', 'delightful', 'joyful', 'exciting', 'thrilling' and others, for their potential for recounting deepfelt experience in natural ways that were true representations of their original experience. Frederick Turner says, in considering an evolutionary theory of meaning and value in a temporal universe : "..value evolved slowly in the universe.....a word occupies the last and most temporally complex milieu in the evolutionary series that contain other terms like meaning, referent, representation and value.....later and more advanced mileux embrace and include earlier ones, though with all the tragic strains and existential tensions and paradoxes they have accrued in the process. Thus we could well define the relationship of reference or representation, for the kind of word that refers to a non-human object, as one of containment or inclusion - even if the containment is not entirely successful and the inclusion is procrustean in the ways characteristic of a temporal universe (Turner F 1995).

Wittgensteinian 'word-games' and the deconstructionists' notion that words do not mean what they are supposed to mean, have not been allowed to intimidate the straightforward use and meaning of the key words used to trigger experiences.

Observation and Discussion

The surveys with teachers proved to be dismayingly complex as many of them were clearly troubled by the dichotomy of science and maths versus the arts and humanities which included English and language learning. Some research subjects refused to speak about the matter and others refused to address the particular topic of science. It would not be too difficult to conclude that C.P.Snow's prognosis of the late 1950s was correct, but it was discouraging enough to discover in the mid 1990s that the war of disciplines and the false dichotomies within the curriculum were being entertained by the attitudes of a surprisingly large number of teachers. It would prove to be a useful exercise if a large scale survey was taken to determine how teachers in primary through to tertiary levels of education held startlingly unbalanced views that continue to prevail of key skills areas such as Science, Maths and English.

From the surveys of learners' experience the following result held true;

What is beautiful (delightful, lovely) ? - 90% of responses included nature or natural objects
What is joyful (enjoyable, makes you happy)? - 90% of responses included social/interactive aspects
What is exciting (thrilling, amazing) ? - 90% of responses included cultural artefacts

For triggers, the role of imagination was significant. Imagination it seemed was the kernel from which many interactions with nature, words and metaphor would arise. Final analysis of learners' interviews pointed to the power of words with responses being derived from a variety of intertwined elements such as real life experience , imaginative exercises, what they see and hear, and what they receive when they do practical things - performing, acting or playing. The characteristics listed below have arisen as clear cut experiences that were recalled by the "triggers";

1. stimulation by nature, natural objects and phenomena , quite overwhelming in the learning process
2. imagination: nearly all research subjects were aware of its function, some could even talk of it
3. words, metaphor - young learners indulged actively in word play and learned from words/metaphor
4. children's need for the secure, the familiar and the 'organic' which impart warmth to surroundings
5. role play, playing out real or perceived drama and demonstrations of play behaviour as in games

The learners provided a good deal of information from the surveys and interviews and some conclusions are drawn below. The three key themes of the Renaissance outlined at the beginning of the paper (art as continuing nature's creativity, creation by verbal fiat, and interdisciplinary character of the creative process) have emerged stronger still.

There was evidence from the naturalistic research that nature acts as a formidable teacher; it uplifts, activates, motivates and inspires learners into intense stimulation. Interactions of nature to creative art and imaginative activity, and performance based role play can animate young learners and give them an edge to learning. Their preference to actual performing arts, role play exercises and computer role playing games is consistent with their affective experience.

Confirming the neuropsychologists' three components, learners did demonstrate aesthetic experience through, first, their senses (seeing and hearing); second, their affective and emotional feelings in their engagement with story, rhymes, play, social interaction, drama and other 'performance'; and three, motor-executive activity of drawing, painting and creative writing in making prose and verse. These modes can help in giving a specific focus on 'the beautiful', in bringing out the best in children in relation to their engagement with the curriculum and the classroom learning ethos.

Children in the range 8-12 years who can be highly stimulated by nature's creativity, and doing elementary science successfully, appear to be quite ready to take on proper "hands on" science learning if only in the form of simple experiments and explanations. There is a high degree of awareness of science, mainly of physical processes (physics), materials and structures (chemistry), and life and living processes (biology), and some of their applications. Their level of attention and curiosity may justify an earlier introduction to science than they are allowed at present (currently the Key Stage 2 science learning is restricted to nature study only, a fact lamented (Khwaja 1996) in the analysis in *Interpretation of the New National Curriculum).*

From the experience of research and analysis of findings, to stimulate young learners (such as those who were interviewed), towards a developing sense of aesthetic awareness, classroom teaching and instruction need to be a more dynamic, not necessarily physical, activity. Flexibility and variation in teaching style may, while having much appeal, be a valuable strategy. Teachers may also need to use prosody and body language to be expressive and heighten awareness through the performance element as in drama and history and in story-telling and other exercises, developing a style of charisma and probity of their own. These qualities of the teacher can support learners to effective learning that is

also pleasurable (one is persuaded to believe that if contemporary teachers did not have these qualities, they may well be replaced most effectively by swarms of interactive computers who perform very well!).

Learning processes and experience outside the classroom may be regarded just as important in a learner's overall awareness and perception of the world which adds to the learning. Further research might probe out-of-classroom experience especially of the powerful inducements of aesthetic experience in regard to a youngster's overall well being and the pleasurable and continuing engagement with the curriculum.

The results obtained so far is not sufficient even to pursue some of the barest dimensions outlined in the theoretical frameworks. Save to say that those theoretical frameworks are themselves in the process of developing, and that they need to be worked into research questions susceptible to empirical investigation before further testing can be done. The current framework restricts research to classroom based learners with a limited time span for interviews and data gathering. More variation can take this project further, and further testing might include children with adults in their immediate family setting, and older learners in university and even adults in learning situations.

Conclusions

From a reasonably modest sample of research subjects, mainly young learners, some of the main ingredients of their aesthetic experience can be identified which do seem to exert power and influence on their learning. By no means a perfect vehicle, the youngsters' own articulation of their deepfelt 'beautiful' experience have demonstrated the influencing effect of sensory-perceptual, affective-emotional and motor-executive aesthetic experience at work, thus framing their learning experience as one that is generated by love, not labour.

Given the power of being 'delighted', 'excited', 'thrilled' the teaching and learning of key skills including science may be enhanced by the development of a suitable aesthetics that will include both the visual and auditory perception. Science needs considerable visual representation, but that it needs the appropriate auditory output may also be true when the teaching and learning aspects are involved. Peter Medawar recalls that in the learning of (biological) concepts ".... distinctions need to be seen by students but can be further helped by an apt metaphor which turns it on.." (Medawar 1978). In life science, natural objects as examples for instruction in the classroom or laboratory comprehensively overshadows and replaces text book pictures and even film clips, though the latter is a sound way of knowing about things when natural objects are unavailable. In the last few years aesthetic approaches to science learning have been enhanced by the use of specific 'ensembles' of explanation and 'rhetorics of the science classroom' developed by Jan Ogborn and Gunther Kress (Ogborn and Kress 1996). Teachers in the past 3-4 years have felt the need to use a variety of learning resources and to match it with a wide range of teaching and learning strategies in order to make certain that the enthusiasm of the learners are not left high and dry. 'Intrinsic perception' is another element that has recently entered the handbooks of the teacher-training industry, by which one deciphers that the 'normal' perception that we speak of is to be superseded by a deeper 'intrinsic' perception. This may account for the growing importance of visual aesthetics in teaching, though this paper emphasises that the acoustic element is equally a part of the central nervous system and to be attended to, if the power of words have to be reckoned with as a key influencing agent of aesthetic perception and learning.

A key from Renaissance learning tradition and the frameworks of the new aesthetics is that teaching and learning of key skills and indeed of all other disciplines, can benefit from a style that enhances 'pervasive' learning or learning from a feeling of intense enthusiasm, delight, excitement or thrill, and that these can be provided by a suitable combination of the five main basic ingredients of aesthetic experience as analyzed in the research observation - nature, imagination, metaphor (words), security of

surroundings (organic environment), play behaviour. These ingredients on their own or in tandem with others, 'instruct' while 'delighting' the senses. A true learning experience need to be accompanied by feeling, pleasure and a sense of continuity which makes for the generation of love, not labour,. in all learners.

THE AUTHOR BEGS LEAVE OF THE CHAIRMAN AND MEMBERS OF COMMITTEE 2, TO CONTRIBUTE THIS PAPER TO ITS PROCEEDINGS AND TO ACCOUNT FOR HIS PERSONAL ABSENCE IN WASHINGTON D.C.

THE AUTHOR, WHILST CURRENTLY ENGAGED IN TEACHING MATHEMATICS, PHYSICAL AND BIOLOGICAL SCIENCES AND THE HUMANITIES, TO FOUR COLLEGES OF THE LONDON FURTHER EDUCATION INSTITUTIONS NETWORK, CONTINUES TO WORK IN EDUCATIONAL RESEARCH AT CAMBRIDGE, DELIVERS LESSONS IN BASIC SCIENCE TO STUDENTS WITH SLDD AND MLDD (SEVERE TO MODERATE LEARNING DIFFICULTIES AND DISABILITY) AND ALSO TRAINS SPORTS COACHES IN NATIONAL VOCATIONAL TRAINING PROGRAMS.

HIS INVOLVEMENT WITH THE ICUS SERIES BEGAN IN 1972. AS ONE OF THE PRINCIPAL ORGANIZERS HE DEVELOPED THE ROLE FOR EXTENDED WORK IN EUROPE AND AFRICA IN THE 1970s AND 1980s. AS SECRETARY-GENERAL OF THE LONDON ICUS IN 1974, HE FOSTERED THE PARTICIPATION OF FOUR CHAIRMEN OF ICUS – LORD ADRIAN, SIR JOHN ECCLES, R.S. MULLIKEN AND E.P. WIGNER. HIS WORK FOR ICUS CONTINUED TO FLOURISH WITH THE CLOSE SUPPORT OF BRITISH SCIENTISTS SOME OF THEM - R.G.W. NORRISH, DENNIS GABOR, SIR HANS KREBS, A.J.P MARTIN - ACTING AS ADVISORS. IT WAS THE UNDOUBTED PEDIGREE OF THE EARLY ICUS INTELLECTUAL FIRMAMENT THAT INSPIRED THIS RESEARCH AT CAMBRIDGE IN AESTHETICS AND ITS RELEVANCE TO TEACHING AND LEARNING KEY SKILLS INCLUDING THAT OF SCIENCE. THIS PAPER INCLUDES SOME OF ITS MAIN STRANDS.

REFERENCES

Attenborough Sir David (1978) *Life on Earth* London: BBC

Atenborough Sir David (1986) *The Living Planet* London:BBC

Ashton-Warner S (1980) *Teacher* London. Virago

Barrs M & Thomas A (1991) *The Reading Book* Centre for Language in Primary Education

Bronowski J (1973) *The Ascent of Man* London: British Broadcasting Corporation

Chomsky N (1975) *Reflections on Language* New York:Pantheon

Csanyi V (1991) "Mind and Cognition: Limits of Understanding" in proc. of *XVIII International Conference on Unity of the Sciences* New York: ICF Press

Davies P (1983) *God and the Physicists* London:

Easterlin N (1995) paper to proc *XX International Conference on the Unity of the Sciences*

Egan K (1992) *Imagination and Education* Boston:

Eibl-Eibesfeldt I (1975) *Ethology: The Biology of Behaviour* Holt, Reinhart & Winston

Eigen M & Winkler R (1981) *Laws of the Game: How Principles of Nature Govern Chance* New York: Knopf

Epstein D et al (1988) *Beauty and the Brain Berlin*: Springer Verlag
Feigenbaum M J (1983) *Universal Behaviour in Non Linear Systems* Los Alamos Science 1,1, 1980 p 4
Finkelstein D (1983) "Coherence and Possibility: The Logic of the Innermost Universe" *Kenyon Review* Spring
Gell-Mann M (1962) "The Challenge is to find Adventure" in Berland T (Ed) *The Scientific Life* New York: Coward- McAnn Inc.
Glenn S M & Cunningham C C (1983) What do Babies listen to Most ? in *Developmental Psychology* , No 19
Hardy Sir Alister (1979) *The Spiritual Nature of Man* Oxford University Press
Hardy Sir Alister (1982) *Darwin and the Spirit of Man* Oxford University Press
Hudson L. (1962) *Contrary Imaginations: A study of the English Schoolboy* London: Methuen
Hepburn R (1984) Philosophical Lectures and Essays, University of Edinburgh
Huizinga J (1949) *Homo Ludens* New York: Random
Levy J (1984) "Interhemispheric Collaboration: Single-Mindedness in the Asymmetric brain" in Best C T (Ed) *Developmental Neuropsychology and Education: Hemispheric Specialisation and Integration* Academic Press
Levy J & Harris L (1995) "Neuropsychological Analysis of Aesthetic experience proc of *XX International Conference on the Unity of the Sciences*
Mandelbrot B (1983) *The Fractal Geometry of Nature* New York: Freeman
Medawar P B (1978) *Life Science: A conceptual framework of modern biological science* London: Wildwood House
Meek M (1991) *On Being Literate* London: Bodley Head
Menuhin Y (1960) *Art and Science as related concepts* London
Motz L (1986) "Symmetry and the Laws of the Universe" proc *XV International Conference on the Unity of the Sciences*, Washington DC
Needham J (1941) *Time the Refreshing River: Essays in Biology and Philosophy* Cambridge University Press
O'Brien E et al (1986) (Ed) *Essays on Shakespeare in Performance* London: Methuen
Ogborn J & Kress G (Ed) *Explanation in the Science Classroom* Milton Keynes: Open University Press
Ogden B & Richards I (1923) *The Meaning of Meaning* London: Harcourt Brace
Olds J (1976) *Behavioural Studies in Hypothalmic Functions: Drives and Reinforcements* in Grenell R G & Babay S (Ed) *Biological Foundations of Psychiatry* vol 1 Reven Press
Poppel E & Turner F (1983) Neural Lyre: Poetic Meter, The Brain and Time *Poetry* Aug 1983 p 277
Pribram K H (1969) "A Review of Theory in Physiological Psychology " in Pribram K H (Ed) *Brain and Behaviour* vol I, Mood, States and Mind
Saw R (1972) *Aesthetics: An Introduction* London: Macmillans
Schechner R (1977) *Essays on Performance theory 1970-76* New York: Drama Book Specialists
Scorer R S (1974) "Popular and Professional Illusions about the Scientific Method " proc of *III International Conference on the Unity of the Sciences*
Scorer R S (1976) *The Clever Moron: Essays on Science, Society and Politics* London: Routledge
Snow C P (1959) *The Two Cultures and the Scientific Revolution* Cambridge University Press
Thorpe W H (1976) "Science and Man's Need for Meaning" proc *V International Conference on the Unity of the Sciences*
Turner F (1985) *Natural Classicism : Essays on Literature and Science* New York: Paragon House
Turner F (1995) "Ecopoetics of Meaning" proc *XX International Conference on the Unity of the Sciences*
Turner V W (1968) *The Drums of Affliction* Oxford University Press
Turner V W (1969) *The Ritual Process* Chicago: Aldine
Turner V W 1974) *Dramas, Fields and Metaphors* Cornell University Press
von Uexkull J (1921) *Umwelt und Innerwelt der Tiere* Berlin:: Springer International
Werner Reimers Stiftung (Foundation) (1983) Proc of study group on the *Biological Foundations of Aesthetics*, Bad Homburg, Germany
Willer J C et al (1981) "Stress-induced Analgesia in Humans: Endogenous Opiods and Naxalone reversible depression of pain reflexes," *Science*, 212
Wilson P J (1980) *Man the Promising Primate* New Haven: Yale University Press
Zollinger H F (1979) *Studies of Psycholinguistics of colour vision*, Swiss Federal Technical University, Zurich