
HEDGEHOGS, FOXES, CROWS, AND OTHER ‘INTELLIGENT’ BEINGS: EXPLORATIONS OF THE RELATIONSHIP BETWEEN MULTIPLE INTELLIGENCE THEORY AND DESIGN & TECHNOLOGY

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Abstract

For almost two decades, Howard Gardner’s Theory of Multiple Intelligences (MI) has been in the public arena. Welcomed by educators for its erosion of the concept of a single (and measurable) intelligence, MI theory better addresses the complexity of the human mind. Rather than arguing conclusively for or against the recognition of, for example, design intelligence, the paper discusses some of the issues involved in exploring any perceived relationship between MI theory and Design and Technology.

Introduction

The paper opens with an overview of the history, and some major interpretations, of the notion of intelligence. This provides the background to Gardner’s development of his Theory of Multiple Intelligences (Gardner, 1993b&c). Description is given of what, for Gardner, constitutes an intelligence and of the several intelligences he has nominated. This is followed by some critiques of multiple intelligence (MI) theory. There follows an outline of what is understood to be Design and Technology (D&T) and then a discussion of the relationship, actual or potential, between Design and Technology and MI Theory.

Intelligence: an overview

Without presenting any detailed discussion of the ways ‘intelligence’ is used in lay circles, everyday conversations, in the media or in non-psychological professional settings such as teaching, we move forward knowing that there does not exist a concise and common understanding of the term even amongst those on whose professional work it hinges. One might express a cynical note of concern considering this situation is the premise of ‘intelligence tests’. Indeed, Boring’s (1923) definition of ‘intelligence is whatever the tests test’ is popularly reported (Sternberg, 1987:376; Heil, 1995:411; Kornhaber & Gardner, 1995:109). Most recently, Gardner describes the remark as ‘…famous – if irritating’ (Gardner, 1999c). Sternberg (1987) takes this logic further by pointing out that, since tests differ, one is left with as many definitions as tests and, whatever that number is, it is certainly far in excess of the number of expert opinions one might gather. ‘Innumerable tests are available for measuring intelligence yet no one is quite certain of what intelligence is, or even of just what it is that the available tests are measuring.’ (Sternberg, 1987:375).

Gardner has said that ‘(l)ike many concepts in psychology, intelligence has a long past but a short history’ and he identifies three principal controversies which have surrounded the study of intelligence ‘almost since its inception’ (Gardner, 1999a:434). First, questions of whether intelligence is inborn, acquired, or if, and to what extent, it is a mix of these, remain unanswered. Second is the question of whether there is a single, general, intelligence or multiple intelligences.
(The matter of hedgehogs and foxes.) The third controversy concerns the issue of bias that has been present from the earliest Binet tests (late 1800’s in France) and, while ‘considerable efforts have been evinced to eliminate’ cultural or racial bias in more recent years, there remain deep concerns about testing and about the uses to which the results are put (Gardner, 1999a:434). In his commentary on Binet, Zangwill suggests that ‘…the recent tendency is to interpret the results of intelligence tests with extreme caution’ (Zangwill, 1987:88). Meanwhile, Barlow has written of intelligence as ‘the art of good guesswork’ and refers to the ‘…intellectual revulsion against the psychometricians’ simplistic arrogance in promoting the IQ as an adequate measure of an individual’s mind, and (the)…moral revulsion at the degradation and insult to whole racial groups that has resulted from this approach. (Barlow, 1987:381). The moral revulsion dimension was more recently inflamed by Hernstein & Murray (1994) who argue that unintelligent people ‘…are a drain on society and that society will eventually form itself into two classes: the privileged intelligent…and (the) increasingly underprivileged unintelligent…’ (cited in Fogarty, 1999:205).

Many current authors and researchers concerned with intelligence theory describe its 100-year-plus history, the elusiveness of definition, the enormity of the literature, and the rapid expansion of research in the last couple of decades. Most would also agree with the observation that, ‘Almost since its inception, the study of intelligence has been surrounded by controversy.’ (Gardner, 1999a:434). Before moving on to Gardner’s work, it should be noted that any discussion of the history of the concept of intelligence ought ideally to include discussion of creativity – the two are interwoven though should not be conflated (Gardner, 1999c). Indeed, creativity is of optimal interest to D&T educators. While the study of intelligence has grown for over a century, that of creativity emerged from around the 1950’s (Vernon, 1970). It should also be noted that the study of intelligence has gained much momentum from other fields of study, notably artificial intelligence.

Gardner's background and interest in intelligence theory,
Professor in Cognition and Education and Adjunct Professor of Psychology at Harvard and of Neurology at Boston University, Gardner is an eminent scholar and prolific author. Over many years he conducted two streams of research on cognitive and symbol-using capacities – one with normal and gifted children, the other with adults who suffered from brain damage. ‘My effort to synthesise these two lines of work led me to develop and introduce the theory of multiple intelligences…’ (Gardner, 2002). It is clear that Gardner has had not only a genuine professional interest in neurological and psychological understandings of human mental potential and performance but that he comes to these with a genuine ethical care for the good of all. He seeks to articulate the potential of the individual for the common good while taking the greatest of care not to support the socially divisive ways in which this work can be (ab)used. He contends that:

…the stranglehold of the psychometricians has at last been broken. Yet (he cautions) …we risk deciding that anything goes – that emotions, morality, creativity, must all be absorbed into the “new (or even the New Age) intelligence.” The challenge is to chart a concept of intelligence that reflects new insights and discoveries and yet can withstand rigorous scrutiny. (Gardner, 1999c)

In making his case for multiple intelligences, Gardner draws on studies of prodigies, individuals, brain-damaged patients, idiots savant, normal children, normal adults, experts in different lines of work, and individuals from diverse cultures. However, he also seeks to expand the fields of cognitive and developmental psychology and to explore the educational implications of MI theory (which he has since done in increasing depth). Further, he aimed to ‘…inspire educationally oriented anthropologists…’ and (‘most important’) offer his work as something that would ‘…prove of genuine utility to those …charged with the development of other individuals’ (Gardner, 1993c:9-10).
Gardner’s focus
One can find in Gardner’s work a variety of approaches to defining intelligence (Gardner, 1993a:35; 1993b:xiv; 1999a:434). Perhaps the most encompassing statement has been that ‘(i)ntelligence is a biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture.’ (Gardner, 1999b:34). However, definitions have their limitations and tend not to be very practical. To this end, Gardner sets out what he calls the ‘signs’ or ‘criteria’ of an intelligence, preferring the former term for its allusion to the provisional nature of a ‘candidate intelligence’. Before setting out his signs/criteria, it is worth reporting his key concern about the use of the word ‘intelligence’. In a pithy ‘crucial’ note Gardner cautions:

There is a universal human temptation to give credence to a word to which we have become attached, perhaps because it has helped us to understand a situation better. …intelligence is such a word; we use it so often that we have come to believe in its existence, as a genuine tangible, measurable identity, rather than as a convenient way of labelling some phenomena that may (but may well not) exist.

The risk of reification is grave in a work of exposition… These intelligences are fictions – at most useful fictions for discussing processes and abilities… (Gardner; 1993c:69)

The signs (without any order or hierarchy) are: potential isolation by brain damage; the existence of idiots savant, prodigies, and other exceptional individuals; an identifiable core operation or set of operations; a distinctive developmental history, along with a definable set of expert ‘end-state’ performances; an evolutionary history and evolutionary plausibility; support from experimental psychological tasks; support from psychometric findings; and, susceptibility to encoding in a symbol system (Gardner, 1993c:62-66).

The seven original candidate intelligences with their respective core operations were: Linguistic (syntax, phonology, semantics, pragmatics); Musical (pitch, rhythm, timbre); Logical-mathematical (number, categorisation, relations); Spatial (accurate mental visualisation, mental transformation of images); Bodily-kinaesthetic (control of one’s own body, control in handling objects); Interpersonal (awareness of others’ feelings, emotions, goals, motivations), and, Intrapersonal (awareness of one’s own feelings, emotions, goals, motivations). A decade later Gardner had modified his notions of the intrapersonal and was also considering the merits of adding a spiritual intelligence. However, this latter he rejected but by the late 1990’s he had added: Naturalist (recognition and classification of objects in the environment). By the end of the 1990’s the case for existential intelligence – awareness of, and concern for, the fundamental questions of existence - is under scrutiny but this does not yet seem to meet all the criteria. This is certainly borne out in the spirit of his recent thinking where he articulates philosophically on what he perceives to be the:

…enduring importance of two values: … Responsibility; and a Respect for Humanity. We encourage students to carry out work, but that work needs to be good in two ways: exemplary in quality but also responsible…The second value is an appreciation of what is special about human beings. Human beings have done many terrible things but countless members of our species have done wonderful things as well… (Gardner:2001)

Gardner argues that all people possess all eight intelligences, possibly more. He also argues that people possess the intelligences in different proportions – such is the nature of our individuality that results from the blending of hereditary and environmental influences. One finds in Gardner’s writing that essential ethical care in stressing that the concept of MI is a proposal, an offer, and, above all, a theory - to be taken and tested, worked and re-worked for its validity. It is 20 years
since the promulgation of the concept and there is a critical educational debate afoot. For those who subscribe to the view that there is nothing so practical as a good theory, MI has something powerful to offer education – not least on ethical and pedagogical grounds. The professional psychological debate about the theory’s validity continues as the research expands. In the meantime there will continue to be no shortage of misinterpretations, bandwagons and watered-down hobby versions for people to promote (and educators will not be innocent of this). Gardner himself is happy that educators and others have taken up the cause but, rightly, he will not, or cannot, pass judgement on the quality of what is on offer. He has contributed to some texts by way of preface or occasional chapters and there are useful publications that largely respect the integrity of his work (see e.g. Lazear, 1991; Armstrong, 1994; Lazear, 1994; Fogarty & Bellanca, 1995). Gardner has refuted the notion of a ‘recipe’ for MI education and has favoured ‘…an education framed in the “spirit” of multiple intelligences.’ (Gardner, 1993d:66).

Critiques of MI theory
This paper is not able to engage in a detailed critique of MI theory. However, the following are seven key criticisms stemming largely from the professional psychology community: i) there is difficulty in seeing how all the intelligences can meet all of the eight criteria; ii) the nomination of the eight intelligences seems somewhat arbitrary and therefore subjective; iii) by offering ‘multiple’ intelligences the word ‘intelligence’ is rendered meaningless; iv) on the single versus multiple theories issue, Thurstone’s multiple factor analysis theory was based on empirical data whereas Gardner’s work is more a subjective/empirical mix (Fogarty, 1999:200); v) ‘intelligences’ is just another word for, traits, abilities, cognitive styles, sensitivities, skills etc rather than a clear isolated construct. The issue is therefore a matter of semantics; vi) just because the theory offers an ethical alternative to IQ/standardised tests does not necessarily negate the existence of ‘g’ – a general factor of intelligence; and, vii) if there are eight intelligences then it must be possible to design eight matching tests. This, argues Gardner, is to default to the psychometricians’ position on standardised testing - ‘repeating the sins of intelligence testing’ (Gardner, 1993b:xxvi). He contends that assessment that supports student learning is far preferable to testing that is used to sort and grade students. Gardner readily acknowledges the concerns held by many critics and he has made a variety of responses to them (e.g. Gardner, 1993b:xxiii-xxvii; 1993d:35-48; 1995).

The nature of Design and Technology Education
Some brief elaboration is now necessary on what is understood to be D&T. In the simplest of terms, technology might be taken to mean anything that the species has built or made and design refers to the intentions and choices followed in arriving at the technologies. It is immediately acknowledged that every noun or verb in the previous sentence is open to debate so an amount of criticism and ‘definition by default’ may be helpful. Technological activity, possibly even design activity, is by no means the privilege of our species (the matter of the crow). Design is certainly central to the development of technologies. In educational terms ‘design’ and ‘technology’ cannot be constrained. Design is not mere planning, nor drawing, nor a single process – linear or cyclical, nor ‘neat ideas’. Design is far from tangible. Design is both noun and verb. It is about working with imperfect information from an uncertain starting point and without single or ‘right’ answers. Design is educationally very powerful.

Technology is not mere objects, nor simply applied science, nor only computers, nor inevitable, nor skilling alone, nor neutral - the orthodoxies of technology education (Keirl, 1999). Technology is pervasive yet seemingly invisible, intimate to our very existence, ethically problematic, values-rich not values-poor. Together, design and technology in education provide for a current curriculum inadequacy. D&T curriculum must take a critical, holistic and dynamic form by embracing matters of thinking, ethics, existence, determinism and politics (see e.g. DETE, 2001). The pedagogy of quality D&T could well be the richest and most sophisticated in the curriculum. It should be noted
that the perspectives espoused here are not universally shared by Technology educators. The field is undergoing much change at present and debates abound. Fuller accounts of these perspectives and current D&T theorising are presented elsewhere (Cross, 1995; Winner, 1995; McCormick, 1999; Harrison, 2000; Middleton, 2000; Seemann, 2000; Keirl, 2001a; Keirl, 2001b; Kimbell & Perry, 2000).

**Multiple Intelligences and D&T**

*MI in D&T or D&T in MI? Is there a fit?*

For a D&T educator to review Gardner’s work and to encounter the following one of his working definitions, expressions such as ‘a sight for sore eyes’, and ‘at last, somebody really understands’, come to mind: ‘An intelligence is the ability to solve problems, or to create products, that are valued within one or more cultural settings – a definition that says nothing about either the sources of these abilities or the proper means of ‘testing’ them.’ (Gardner, 1993b:xiv). D&T activity is about solving certain kinds of problems and is certainly about creating products using many abilities. The matter of evaluation, critique or performance assessment is a part of practice too. However, Gardner is offering an encompassing working definition and not something for any one enterprise to covet as its own. Gardner’s enlightened and ethical approach to ‘intelligence’ offers huge potential for education – to liberate from the chains of disciplines and tradition as well as to facilitate democratic and student-centred pedagogy. So it is the case with a forward-looking technology curriculum. If design-based learning is facilitated it will be through respecting the diverse nature of students and of learning styles. If technology education is to be truly educative it will have a real and honest place in the curriculum - one that is articulated through a variety of learnings rather than constrictive set-piece pedagogies and knowledge bases (propositional, procedural, or otherwise). The pedagogical and institutional prerequisites for quality D&T match those for ethically defensible MI theory.

The reciprocal of this position is that MI theory is far better articulated through holistic curriculum projects such as a comprehensive quality D&T education than through the majority of current approaches. So far as the eight ‘and a half’ nominated intelligences are concerned, the degree of match obviously hinges on the richness of one’s understanding of technology education. If it is seen as applied science then a couple of intelligences dominate, if it is seen as computing, again a couple, if skilling then others, and so on. If, however, one accepts a holistic and critical D&T curriculum then the picture is different. While one or another intelligence might be less well served, the fact is that all are served to some significant degree. It is also the case that the existential, the ‘half’, could be readily articulated through quality D&T education too.

Alternatively, one might explore whether a design intelligence or a technology intelligence could exist. The professional D&T education community could well argue the case – especially if it enlisted the continually growing research from our counterparts in the extensive range of professional design and professional technology fields. To argue this position might be valid within MI theory but it would also contribute to the criticism of MI that there are many other candidate intelligences. All that is needed is a strong enough case to be put. This may be a goal that D&T education might seek but it is hardly equipped to do so at the moment.

**Gardner and technology: from dissonance to harmony?**

However, there is another matter to consider here and it is one that interplays with the D&T/MI relationship. It concerns Gardner’s own understanding of technology, and for that matter, of design. It is a truism that many people in learned and senior management positions are unable to make informed judgements about anything to do with design and technology because they have simply never had the benefit of a quality D&T education. For the D&T education community, this phenomenon is the source of much bad managerial and curriculum decision-making.
There are a few criticisms to be recorded regarding Gardner’s understanding of technology. First, his writing is a classic model of those who see technology as applied science. All the regular symptoms are displayed: the compounding of technology with, but always after, science; the unstated assumption that by writing ‘science’ the reader will assume a subtext of ‘and technology’, (always after); and, the continuing discussion of significant global technological issues – technological change, nuclear armaments, genetic engineering, nanotechnology – under headings of ‘science’.

At another level he misses the holism and pervasiveness of technologies when he argues a ‘traditional and conservative’ position on education (for which, he says, “I make no apologies”). He advocates: ‘…training (students) in the three basic literacies (Reading, Writing, Calculation)…and then introducing them to the major families of disciplines: science…; the study of art and nature…; and history and literature…’ (Gardner, 2001). While this position may fit his concerns for MI theory and be admittedly a personal position it may well beg consternation from leading curriculum thinkers.

On other points regarding the true nature of technology Gardner also uses ‘technology’ to refer to computers – but then he is hardly alone in this. He presents a useful piece on ‘The evolution of body skill’ (Gardner, 1993c:216-221) in his discussion of bodily-kinaesthetic intelligence but it fails to articulate with a contextual discussion of tool-use technology. In a discussion of applications of spatial intelligence (Gardner, 1993c:191-192) the word science dominates when the recording of data about ‘machines and organisms’ is under discussion while in the same three paragraphs engineering, architecture, and printing are cited without reference to technology. There is an irony here when Gardner cites Ferguson: ‘According to …Ferguson, many of the problems in which scientists and engineers are engaged cannot be described in verbal form.’ (Gardner, 1993c:191). It is doubtful that Ferguson would have juxtaposed scientists with engineers as he has this to say:

(For) more than 350 years…promoters of the mathematical sciences have convinced their patrons that science is the way to truth and that it is also the chief source of the progressive inventions that have changed the material world. The myth that the knowledge incorporated in any invention must originate in science is now accepted in Western culture as an article of faith, and the science policies of nations rest on that faith. (Ferguson, 1992:155)

Another link occurs between Gardner and Ferguson. As an example of spatial intelligence Gardner says. ‘If one had to choose a single area to illustrate the centrality of spatial intelligence, chess would suggest itself as a strong candidate. The ability to anticipate moves and their consequences seems closely tied to strong imagery.’ (Gardner, 1993c:192). Meanwhile Ferguson documents numerous examples of engineers and mechanics modelling, designing and ‘building’ complex machines in their ‘mind’s eye’ (Ferguson. 1992). Such dynamic (these are not static pictures) three-dimensional conceptualisation begs recognition in Gardner’s theorising.

On a final note of concern about the lack of representation of technology or design in Gardner’s extensive writing it is disappointing to discover in his text on creativity (Gardner, 1993a) that none of the exemplars he chooses represent such fields. He explores creativity, the study of which, he suggests, ‘shadows the study of intelligence’ and presents studies of seven ‘creative thinkers’ from the period around the Great War. The seven are Freud, Einstein, Picasso, Stravinsky, Eliot, Graham and Gandhi. There is a paper to be written on this matter alone!

The point here is not to denigrate Gardner from a vantage point with which he is not acquainted. The reciprocal could be said of this author’s knowledge of psychological theory. The point is to highlight two issues. The first issue is that of the invisibility of design and technology in MI theory.
While Gardner is developing a universal account of intelligences, one way or another this must account for such existence-shaping human activity as technology and design. If these do not qualify for intelligence status in their own right then it will be reasonable to seek their recognition across the candidate intelligences. The second issue concerns what is perceived to be a kind of ‘Catch 22’ that embroils Gardner’s thesis – the issue of what kind of curriculum framework he might better place Frames of Mind. While MI theory has significant potential to debase the socially divisive and iniquitous uses of single intelligence theory and its testing, and it offers a holistic approach to understanding human potential in the individual and collectively, to try to move forward using past, exhausted, paradigms of knowledge organization (for example, his ‘traditional and conservative’ approach) is erroneous. In fact, as new ways of curriculum organization emerge, it will be their very synergy with such theories as MI that will displace the bastions of ‘science’, ‘IQ’, ‘testing’ and ‘disciplines’. Critical and holistic D&T, freed of its orthodoxies, will move forward in harmony with MI theory. Neither of these can flourish in hidebound educational organisational models.

Assessment
Another paper would address the assessment issues that arise out of this discussion but some key points ought to be noted. If one achievement of MI theory is the erosion of the use of IQ tests for ‘sorting’ or ‘measuring’ children, there remain concerns that a whole new suite of tests for each intelligence aren’t developed and ‘applied’ with equally divisive consequences. The assessment challenges embodied in D&T education are much those of MI theory. What matters at the absolute centre is the ethical question of ‘why assess?’ and ensuring that assessment assists learning. There is a long history of prescribed bodies of knowledge and tests amounting to being ‘the tail that wags the curriculum dog’. If assessment is developed that benefits the potential of the individual and informs the teacher of ways that the individual’s learning can be enhanced then it will be worthwhile assessment. In essence, if we teach to ‘g’ and measure ‘g’, we will be educating in ‘g’. MI theory and D&T practice are about rather more than ‘g’-type notions.

Epilogue
So to the title of this paper via Ancient Greece. Gardner draws on Berlin’s (1998) analysis of the Greek poet Archilocus’s distinction between the hedgehog and the fox.

(Archilocus said)…’The fox knows many things but the hedgehog knows one big thing.’ Scholars have differed about the correct interpretation of these dark words, which may mean no more than that the fox, for all his (sic) cunning, is defeated by the hedgehog’s one defence. But, taken figuratively, the words can be made to yield a sense in which they mark one of the deepest differences which divide writers and thinkers, and it may be, human beings in general. For there exists a great chasm between those, on one side, who relate everything to a single central vision, one system, less or more coherent or articulate…and, on the other side, those who pursue many ends, often unrelated and even contradictory…(Berlin, 1998:436

To remind us that we are not the sole technological species one might nominate the crow, archetypal problem solver and tool designer/user. The crow is a canny bird and legendary too. In Aesop’s ‘Necessity is the Mother of Invention’ fable of the Crow and the Pitcher, the crow gets life-saving water from the bottom of the pitcher by dropping stones in to raise the water level. In a recent experiment a crow bent a piece of wire to make a tool to retrieve food from a cylinder. (BERG, 2002)

We are reminded that, as humans, we are technological and we possess multiple intelligences but it would be wise to temper our strengths with a humility towards what we have yet to learn.
References


Gardner, H., (2002), Biographical notes at Project Zero Website, URL: http://pzweb/harvard.edu/Pls/HG.htm


Middleton, H., (2000), ‘Designing research to research design: Some methodological issues in researching design thinking’ in 1st Biennial International Conference on Technology Education 2000 Proceedings, Technology Education Research Unit, Griffith University, Qld.


