

## **Advancing the study of Visual Art as a vehicle of multidisciplinary knowledge in enabling programs**

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Enabling programs across Australia are charged with preparing students for tertiary study by training them in key academic competencies and literacies such as: learning to read, write and think in an academic manner. Central to learning these skills is introducing them to a range of learning opportunities and tasks that encourage them to embrace other ways of seeing the world around them and to be reflective about their own ideas, motivations and practice. At the University of Newcastle, Visual Art is offered in the year-long part-time program to bring about these learning outcomes and is uniquely placed to introduce students to a range of disciplinary knowledge that not only augments study of the practical aspects of art, but also provides insights into a range of disciplines that are rich sources of knowledge about art and likewise shows how art can inform the disciplines. This paper examines some links between art and: pedagogical, historical, philosophical, sociological, cultural and anthropological, political, literary, psychological, scientific and technological, mathematical, business and management paradigms that help students understand the significance of art to their lives; and their lives to art. In studying this enabling subject, students learn to discern layers of meaning that deepens their engagement in artwork and also educates them more broadly in preparation for undergraduate studies.

In order to develop their own creative practice, Visual Art students must gain an awareness of other paradigms which expand and reflect their knowledge of lived experience, both past and present, as well as inform abstract interpretations that express emotional states. Visual Art as an enabling subject trains students to see the wider importance of theoretical analyses, a key pedagogical component of tertiary preparation. Therefore it can be argued that Visual Art provides an important opportunity to combine the aesthetic and practical processes involved in creating art work with deeper theoretical and disciplinary knowledge. The links between Visual Art and other disciplines provides an opportunity to broaden students' foundational knowledge. An extensive literature review was undertaken to examine these links: firstly to explore literature on any enabling courses or tertiary preparation courses that commented on visual art curriculum and practice; secondly to examine literature that highlighted the interconnections and relevance of taking an interdisciplinary approach to the study of art.

### **Pedagogy and Art**

Research that has examined the multidisciplinary potential of Visual Art and comments on its effectiveness as a learning tool includes Fleischmann and Hutchison's (2012) critique of shortcomings of traditional creative arts curriculum. They argue for implementation of multidisciplinary practice which includes a broader framework of collaborative engagement with other disciplines. This is done to some extent at undergraduate level with subject offerings in art history and appreciation, and contributes to self-development as well as acquisition of academic skills. Sandell (2011:48) points out the pedagogical benefits of good teaching which helps students:

*Master new cognitive abilities to develop a cultivated mind that is disciplined; is able to synthesize; is creative; respectful, and ethical; and has the capacity to integrate ideas from different disciplines.*

Understanding art images also allows students to apply this knowledge to their own lives. This deepens their engagement in artwork and, most importantly, encourages divergent thinking skills and "habits of mind" (Sandell 2011:48) that are so important to the development of independent and critical thinking skills.

Patoine (2008) explores the pedagogical benefits of teaching art. She begins her article with a question “Does Art make you smart?” and reports that academic research from seven universities including University of California and University of Oregon “reveals close correlations between training in the arts and improved math and reading skills” (2008:1). The argument put forward is that children who participate in the arts do well academically due to possible changes in attention networks in the brain. The research highlights correlations between artistic endeavours and cognitive abilities. One theory put forward to support these universities’ findings is that children who are interested in art are motivated to practice it with focused determination and that motivation leads to sustained attention, which in turn leads to efficiency of the brain network involved in attention and cognitive improvement. The research results suggested absorbing a child in an art form is one way to train attentional networks. Neurologist Scott Grafton (cited in Patoine 2008) from the University of California found learning via effective observation is related to learning by physical practice. Patoine’s (2008) article indicates that effective observational learning may transfer to other cognitive skills. If, as this research suggests, the full potential of students can be realised through exposure to a broad range of arts training, then these findings have important implications for education policy as well as for considering the benefits of Visual Art as a preparatory subject for undergraduate study.

The importance of teaching visual literacy to students is discussed by Sandell (2011) who makes the point that in contemporary culture there is a preoccupation with “televised acts of transformation” of bodies, fashion and spaces (2011:48). Learning to understand the significance of messages transmitted through this medium is paramount and can be included in Visual Art curriculum. She refers to “screenagers” who live visually and virtually and who are constantly engaged in “creating, sharing, and responding to graphic images” (2011:48). According to Burmark (2002) learners today increasingly need multiple forms of literacy, and visual images are what reading and writing are to words. Jensen (2001) estimated that 90% of information is received visually so there is a dependence on learning to encode and decode visual concepts.

Sandell (2011) also comments on the demand for creativity and innovation among student learners. Art teachers provide access to the meaning of art as a language (2011:49) and are instrumental in developing visual literacy so people can understand, think, communicate and learn. Learning about art requires understanding of form, purpose, ideas and in turn, art teachers put into effect “transformative and informative processes” (2011:49) which allow students to become:

*Proactive learners through direct, firsthand experiences that involve transformative creative processes as well as informative critical thinking processes that apply to learning for life. Quality student engagement in visual art occurs through pedagogy within three interactive studio structures: demonstration and lectures, students at work, and critique* (Hetland, Winner, Veenema, & Sheridan 2007).

Sandell (2011) argues developing literacy skills for the Twenty First Century requires aesthetic sensibility and capacity to give form to ideas and emotions. These are skills which must be cultivated (Jacobs 2010). Sandell (2011) comments “the interdisciplinary nature of the visual arts correlates with the sciences and humanities – among other disciplines – to connect life, past and present” (2011:49). She quotes Goldonowicz (1985:17) who states like other languages “Art is a language that can be learned and understood. It is a form of communication that one can learn to read and speak through study and practice.”

Wells (2002) reinforces this point by arguing that meaning-making practices are not restricted to interaction or text, it also occurs in design work where planning and carrying out projects requires considerable expertise. Wells argues that adequate recognition should be paid to “all modes of making and representing meaning through which the activities of learning and teaching are enacted” (2002:2). While teaching Visual Art requires the

modelling of skills and managing of relevant curriculum, it is also a valuable tool for linking into disciplinary knowledge.

### **History and Art**

Berger (1985) makes the interesting point that historically, an interest in art relates to privileged education. Original masterpieces are seen as the preserve of the rich. He reminds us that art was first the experience of ritual, set apart from everyday life in order to exercise power over it. Later, art became social. It entered the culture of the ruling class, was set apart and isolated in the residences of the rich, it was inseparable from authority. Today, however, that authority is removed and art is more available to the general population.

Barchana-Lorland and Galnoor (2009) suggest incorporating an historical approach to teaching art which reviews aesthetic theories from ancient to contemporary and takes a social-critical approach which examines the intersections between art and society, provides a very useful learning experience. The connection between history and art is graphically illustrated in the meanings and symbols incorporated in indigenous art. Tacon (2008) discusses an investigation of rock art of Waanyi country which documents subjects, styles and techniques. The work was undertaken in conjunction with archaeological excavation. Rainbow-like designs as well as depictions of a red and yellow Rainbow Serpent provide insights into Indigenous culture and spirituality. Tacon (2008) notes that use of colour “played a fundamental role in both expressing and maintaining relationships to places” and differs from the way colour is used elsewhere by Aboriginal peoples. Art is one aspect of Indigenous culture that informs their history but is also a way Indigenous identity is communicated and maintained. Their art is both a link to the past and part of Indigenous present day experience (Grieves 2005).

Art has been used in both positive and negative ways to clarify historical events as they relate to Indigenous Australians. In Ryan’s (2012) account of punishments, prosecutions and education of Indigenous Tasmanians, she argues historians relied on drawings to depict these events. For example, Surveyor-General George Frankland requested production of sketches of Aborigines and settlers which would represent “the actual state of things” (2012:113). That state was, of course, from the perspective of the colonial power. Art can be used to construct representations of reality and influence interpretations of history. Teaching students to analyse symbols, consider the impact images have on culture and social structures and how they might influence thinking is crucial. At the same time, however, art provides historical accounts that may not be available in documentary evidence. A collection of artworks created by members of the First Fleet, held by the Natural History Museum, provides drawings of Aboriginal peoples, the environment and wildlife. In some cases it includes records of species that have become extinct since 1788 so is a valuable record of the early colony (Natural History Museum) that is not available elsewhere.

When linking art to history, Berger (1985) argues that the past is mystified which means works of art are unnecessarily remote “The past is not for living in; it is a well of conclusions from which we draw in order to act” (1985:11). Seeing the art of the past situates us in history. A perspective which came from Renaissance art will differ from contemporary appreciation because each era lies in the eye of the beholder. It becomes apparent that what is thought of as reality is only a perspective:

*Painters, sculptors and architects are able to give us clues (and sometimes answers) about the universe that they inhabit, that are available nowhere else. In the absence of words, artifacts can point us in directions we could not otherwise imagine... The power that visual evidence possesses to define what a society considers both normal and eccentric is an asset... images help shape our enquiries (Rabb & Brown 1988:2).*

This quote unpacks the value of looking to art for information about society and individuals: family life in particular eras, gender relations, assumptions, costume choices, character. The messages in paintings relate to and provide details of political and social contexts:

*Images can be as powerful when they attempt to defend or exalt the status quo as when they seek to change or reshape the outlook of their age. But part of the explanation for their power also lies in the analysis of the form and style of the images. This understanding derives from the recognition of art as a special class of evidence, shaped by imagination as well as tradition and purpose (Rabb & Brown 1988:5).*

Artists provide a way of seeing historical events that is sometimes difficult to quantify or to express in words. For this reason Art History is a subject offered at universities across the globe to explore the depth and complexity of artists' explanations of the past.

### **Philosophy and Art**

Barchana-Lorland and Galnoor (2009) state "Philosophising about art opens new possibilities of engaging cognitively with the field" (2009:133). These authors demonstrate the benefits of a collaborative venture between an artist and a philosopher as a teaching strategy: "The dialogue staged the point of departure between philosophical thought and artistic treatment of the themes, allowing the students to witness and to experience a debate." The philosopher prepared the philosophical texts and methodological introduction; the artist selected and presented the case studies. They wished to emphasize different things in the course. Likewise the lecturers began to appreciate and understand each other's point of view. This dialogue helped the students' critical outlook and represented art as a form of social activism. Student assignments in this course made connections between philosophical theories and works of art, students showed understanding of texts, and considered the creative application to art. Student reactions to the course reflected deeper critical thinking and an appreciation of the complexity of the links between philosophy, art and education. Barchana-Lorland and Galnoor (2009) argue that the combination of philosophy and art enrich the understanding of students in their quest for knowledge.

Many famous philosophers have also had a keen interest in art. The great Enlightenment philosopher Diderot (1713-84), for example, discusses the social philosophy of art in his writing; and Heidegger's critique of the work of Van Gogh is widely discussed by philosophers (Schapiro 1994). Heidegger attempted to show "how modernity can be transcended from within through reflection on art" (Cashen 2014) which demonstrates the keen connection between the two disciplines. Danto (1999) ponders the question of whether artists are driven by philosophical concerns or whether art is somehow solving philosophical problems in visual terms. Such questions are incredibly useful for students of art to reflect upon because it may inform their practice as well as their capacity to critique.

### **Sociology and Art**

The opportunity to cultivate a sociological imagination (Mills 1959) finds a rich source in art. Whether it is exploring inequalities of class, race and ethnicity, age or gender, inherently political messages are derived from social contexts. Artists concerned with social injustices use it as an instrument to point out disadvantage and disenfranchisement. Through photographs Neshat (1999 in Samarayi 2002) interprets the role of women in contemporary Iran, highlighting the contradictions women experience within social, political and psychological spheres. She states:

*I'm interested in juxtaposing the traditional with the modern, but there are other more philosophical aspects that interest me as well - the desire of all human beings to be free, to escape conditioning, be it social, cultural or political, and how we're trapped by all kinds of iconographies and social codes (in Judd 1999:165-6).*

Barchana-Lorland and Galnoor (2009:135) claim that art is a site of socialisation and that art teachers play a major social role as agents of socialisation. These authors emphasise the

potential for teachers to train their students in art's critical outlook on society and to create an awareness of the involvement of art in social life (Barchana-Lorland and Galnoor 2009). One way artists themselves do this is by bringing those at the fringes of society into centre-focus. Van Gogh is used as an example of normalising taste. While he is considered canonical today he was considered eccentric and controversial during his own lifetime. "Van Gogh insisted on his artistic method regardless of the zeitgeist" (spirit of the times) (Barchana-Lorland & Galnoor 2009:142). Artists can therefore diverge from the boundaries of their traditional roles in society and change norms and as Bourdieu (2013) explains, also change habitus, the personal tastes and dispositions people adhere to.

Berger (1985) argues that art can assist sociological analysis and vice versa. He encourages development of critical thinking by using pictorial essays and states the way people see things is affected by what they know or believe: "Every image embodies a way of seeing" (Berger 1985:10). The capacity to critically analyse photographs, for example, requires consideration that they are not necessarily entirely accurate records as awareness of the photographer selecting that sight from other possible sights suggests a choice of subject is made. The relation of the photographer to the photographed image involves a manipulation of power (Barchana-Lorland and Galnoor 2009:142). Closer examination of how an image is "framed" can be found in Goffman's (1974) book *Frame Analysis* which alerts readers to perspectives both inside and outside the frame. Goffman also incorporates the idea of "framing confusion" (1974:7) where he discusses how concealing and revealing may also bear upon how people define the situation. Not all people will agree on a common understanding of what is happening in a particular situation but these concepts from the world of art provide explanatory tools for sociological analysis. Goffman uses the language of frame fantasies and ambiguities to explain ways beliefs about the world are managed. Cartoons, comics, paintings, novels, cinema, or the stage all tell things differently.

Berger (1985) claims images can be more precise and richer than literature, and allow viewers to share the artist's experience of the visible. The way people look at art is affected by learnt assumptions about such things as beauty; truth; genius; civilisation; form; status and taste. Using oil paintings as his evidence, Berger argues that norms of gender construction can be ascertained; in works of art the social presence of a woman is different from that of a man. In European oil paintings women were the principal subjects, especially when depicted as nude. These paintings convey how women have been seen and judged as sights, and how normative judgments about women are reinforced. Walters (1978) makes a similar argument about the representation of male bodies in art where classic BC Greek idealisation of athletic beauty was replaced by degradation of nakedness in Christian art; only to be replaced again by another normative construction relating to sensuality and virility during the Renaissance era; and a more modest approach to male nudity in the nineteenth century. A combination of historical and sociological accounts are useful for enabling students to show the social constructedness of images and attitudes toward gender and sexuality across time.

Berger's (1985) work also draws out the benefits of art for consumer culture. It depicts things that can be bought. To have it displayed is like possessing it. Berger argues the oil tradition, in particular, still forms many of our cultural assumptions: an obsession with property; the desire to transform ourselves by buying something more. It presents people we are encouraged to envy. It manufactures glamour (Berger 1985:131). Yet art is about social relations, not objects, a topic explored in Fyfe and Law's (1988) book *Picturing power; visual depiction and social relations*. Art promises happiness as judged by others (Berger 1985:132). Art is also a sign of affluence, the good life. It suggests cultural authority, dignity, wisdom. It is a reminder of the cultivated European (Berger 1985:135). This attitude is demonstrated in Corbey's (1993) description of imperial exhibitions between 1870 and 1930 where indigenous artefacts were able to be visually inspected as exotic and "other" within what Corbey refers to as the context of "European hegemony" (1993:338).

The capacity for art to contribute to an understanding of social behaviour and identity is apparent in the work of Goffman (1976) who analyses the way people are pictured in advertisements “those highly manipulated representations of recognizable scenes from ‘real life’” (Gornick in Goffman 1976:vii). Goffman looks at what those advertisements tell us about ourselves. He asks what is the interplay between fashioned image and behaviour? Goffman also makes observations about gender construction which can be useful when critiquing artistic images. He stated “So deeply does the male-female difference inform our ceremonial life that one finds here a very systematic ‘opposite number’ arrangement” (1976:vii). Goffman argues that scenes embody cultural values and human behaviours are displays. Expression is not instinctive but socially learned and patterned. According to Goffman, advertising:

*Depicts for us not necessarily how we actually behave as men and women but how we think men and women behave. This depiction serves the social purpose of convincing us that this is how men and women are, or want to be, or should be, not only in relation to themselves but in relation to each other (1976:vii).*

This contributes to maintaining “an essential order, an undisturbed on-goingness, regardless of the actual experience of its participants” (1976:vii). By learning how to interpret images, students of art can see that advertising has social and political purposes.

### **Anthropology and Art**

Anthropology is said to provide a view from the outside looking in on other cultures. As such, it encourages comparative analyses which broaden perspectives and prevent ethnocentrism. Students can learn a great deal about cultural awareness, norms and values through art. Kamala Kapoor (1999), art critic and curator, comments on the work of Indian artist Rummana Hussein whose experiences informed her works highlighting religious intolerance. Physical, social, and spiritual elements amongst the Hindu and Muslim sects of India are the focus of her art with historical, religious and cultural knowledge central to the artistic messages. Collaborative work between Indonesian batik textile artists and Indigenous Australians who both use traditional techniques to relate to the spiritual world is described as an attempt to “carry on a kind of dialogue with their ancestors” (Supangkat 1999:194). Symbolism and mythology are considered by these artists as a guide to living, yet at the same time signified cultures undergoing dynamic and constant change. Such collaborations promote connections and cultural awareness as well as an understanding that cultures are not static, but evolving and adapting.

In a paper presented at the Australian Institute of Art Education, Professor Michael Parsons (1994:7) made the observation that meanings of artworks can only be understood in their cultural context. Likewise, teaching art from the perspective of other cultures can add insights into broader cultural understanding and in this sense, art can become a leader in curriculum change, particularly as it applies to racial tolerance. Parsons makes the point that if cross cultural knowledge is socially valued, then it should be promoted and nurtured. Parsons argues for interpretive understanding, a crossing of bridges, from one culture to another which can be achieved through “a visual mode of thinking that needs cultivation” (1994:14). For enabling students such links are imperative, especially for those who have little exposure to people of other cultures. Education is a key component of breaking down prejudices and creating cultural awareness.

### **Politics and Art**

“The artist is the educator of society, and art is his (sic) tool for social change” (Barchana-Lorland and Galnoor 2009:139). Abdul Kareem (1990) points to intersections of politics and art by demonstrating how art production and exhibition was highly controlled by the Iraqi government under Saddam Hussein. Political bias inevitably favoured the government line and was known as “Presidential Art.” At the same time, for many artists, their works provide an opportunity to express dissent or dissatisfaction with controlling regimes. Ali Al-Uboodi (1991 in Samarayi 2006) expresses his feelings of being caught in governmental and

bureaucratic red tape, symbolised by a spider's web. One means of escape for this artist was creative escape, expressed symbolically in visual images or word pictures. Samarayi (2001) uses allegory to symbolize political statements. Heidegger (1971) makes the point that allegorical representation is complex and layered. Artists draw upon features of the world and then present them to the viewer, not as reflections, but rather as "constructions". Art is a cause for reflection and learning.

*The artwork is, to be sure, a thing that it made, but it says something other than the mere thing itself is. The work makes public something other than itself; it manifests something other; it is an allegory. In the work of art something other is brought together with the thing that is made...The work is a symbol (Heidegger 1971:19-20).*

As such, the potential to employ art in political campaigns is obvious and is another area that students of art can be trained to critique.

### **Literature and Art**

Easterlin (2013:661) argues that literature and the other arts are "highly complex cultural products" that are centrally important to human cultural evolution. The creative connection between art and language is most vivid in children's picture books. Evans (2009) encourages recognition of picture books for their creative and aesthetic value. Author illustrators include artworks as integral parts of the storyline and Evans argues they can be used as in-depth and detailed responses to fine art in classrooms. McCoubrey's (1993) collection of articles examines the theme of picture books as resources for art production and response. The relationship between words and pictures is explored through chapters such as "Stories as a Starting Point in Art and Design" (Smith & Taggart); "Author-Illustrator, Students Making Books to link Art and Writing" (McCoubrey); and "The Creative Connection: Art and Poetry" (Pearson & Workman). Art requires understanding of form, purpose, ideas "using it as a qualitative language that, like poetry, explores how, not what, something is" (Sandell 2011:49). Calderone (2008) captures the connection between art and poetry by examining the way poetry has inspired some great Australian artists where imagery provides a rich source of creative ideas. For students, imagery is the essence of uncovering creative expression.

Parsons (1994) was concerned at the distance between visual and verbal thinking and how it was generally assumed that these intelligences were somehow different, arguing instead that, in fact, they are interconnected and complementary forms of cognition. The work of Mandi Havill Reid (2004) presented below, perfectly exemplifies the coalescence of art and poetry. Her beautifully crafted and visually interesting *shape poetry* shows that there is beauty and aesthetic value not just in the words and the images they evoke, but also in the form in which they are presented. Reid uses bell and tree shapes to express philosophical ideas about politics and peace. The imagery, sound and look of Reid's poetry combines visual and verbal.

## Peace, Peace

Though magpies made merry in spring, cicadas  
highnoted summer and autumn winds broke  
ten thousand twigs from a hundred trees,  
I formerly lived in a quaintly quiet  
street of a backwatered country  
town. Serenely adjacent to  
my home, a rarefied  
bushtrack roughly  
led the way to  
a swampy  
silt-free  
froggy  
lake.  
But  
now it  
leads to  
a massive  
development  
of slum-yarded  
palaces, each cheek  
by jowl with its grandiose  
neighbour. The swamp where I  
hunted rabbits and laid flimsy traps  
for birds and frogs (I never caught a fly)  
has been drained of all wildlife—unless you  
count roistering buckos in their maniacal cars!

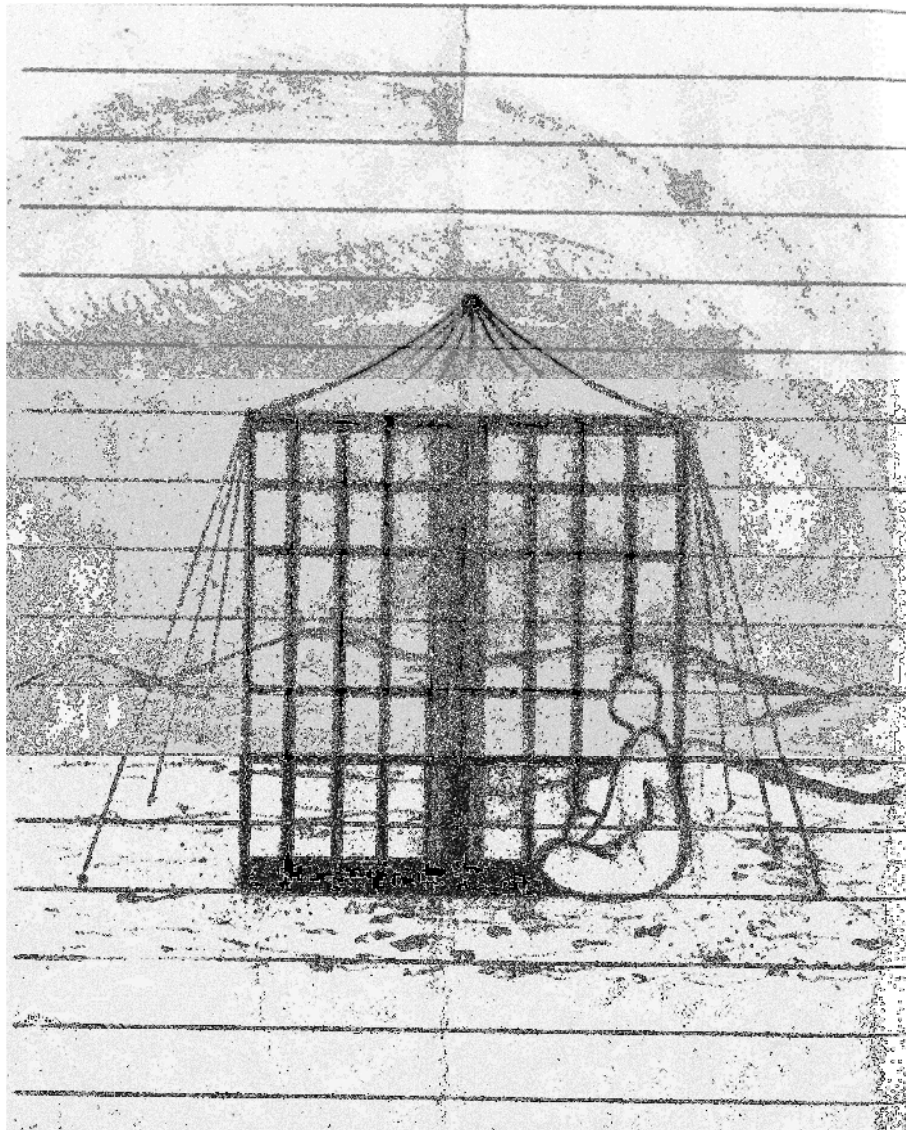
They  
scream  
past my home  
with all the pent-up  
fury of prisoners on day  
release, liberated from their  
classy mock-Tudor prisons of  
pink stucco and mahogany veneer.

Where  
are this lot  
pelting off in  
such abandoned  
haste? Perhaps they  
also search for that fabled  
road in that quiescent country town.

### Psychology and Art

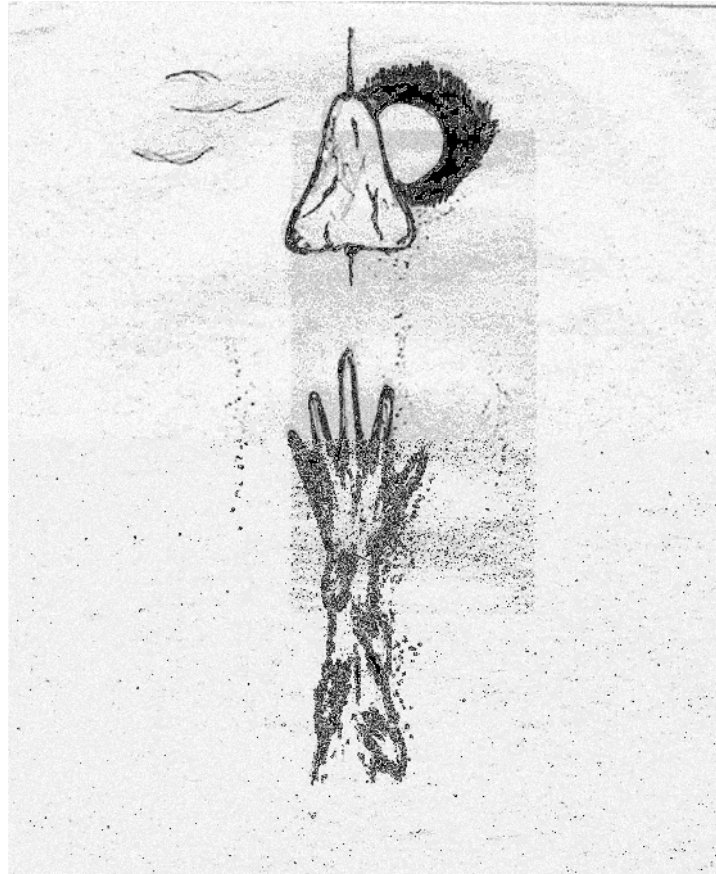
Visual expression of students' emotions through visual art can have deeply psychological effects. It may, for instance, bring to the canvas/surface memories either happy or unhappy, that may need to be dealt with in order to understand them. Ochberg (1991) argues that art contains a "collaborative and empowering principle." It speaks to its creator, and indeed to its viewer, so insights from the discipline of psychology may inform the purpose and outcome of artistic endeavours and art appreciation.





**Ali Al-Uboodi *Constant Prayer*, Pencil on A4 paper, October, 27th 1991**

Al-Uboodi's (in Samarayi 2006) work demonstrates links between art, politics and psychology as he reaches deeply into a mental and spiritual world, expresses his emotions creatively, either as visual symbols or in word pictures. This technique lifted him above the misery of his own internment. Much work has been done on the healing qualities of art as it applies to the lives of refugees in detention (Samarayi 2002) and to art as therapy (Caprio-Orsini 1996; Malchiodi 2002; Winner 1982). West's (2012) work on art therapy with the disabled comments that she has witnessed people being able to express themselves through art in ways they "would normally not get the chance to" (2012:38) and that it assists people to address thoughts and feelings that have been set aside. As a form of self-expression, West argues art develops emotional and behavioural capacities.



**Ali Al- Uboodi *Reach the Bell*. Pencil on A4 paper, 2nd November, 1991**

In the above image Ali Al- Uboodi wishes to make a political statement to authorities in the outside world about the plight of refugees and the need for rehabilitation in a safe and caring environment. His sketch symbolises the frustrations of the refugees attempting to ring the bell, which represents both alarm and freedom. Even the combined effort of the inmates to reach it, fails (Samarayi 2002). Links between cognitive psychology and art also occur in the study of perception, where mental processes such as exploration, selection, simplification, abstraction, analysis, synthesis, completion, correction, comparison, problem solving, combining, separating, contextualizing are ways in which cognitive material is operationalised (Parsons 1994). Learning some of the connections between art and psychology creates an awareness among students about levels of meaning that can be attached to art; and for the artist, this creative endeavour constructs the self (Howey 2001).

### **Science, Technology and Art**

Arapaki and Koliopoulos (2011:800) argue there is juxtaposition of art and science that fundamentally connects them. The relationship between visual art and the natural sciences is exemplified in scientists' ideas about nature and pictorial representation of plants and animals or scientific objects. An overlap with art occurs in spectroscopy in physics (2011:799) and by propagation of light and its influence on the practices of neo-impressionists such as Signat and Seurat; and early abstract painters such as Klee and Kandinski (2011:797). There are also epistemological similarities between art and the natural sciences (Shlain 1991; Miller 1996 in Arapaki and Koliopoulos), in terms of artistic creativity and creative scientific thought. Arapaki and Koliopoulos also emphasize the aesthetic perfection of science [its elegance and beauty] and the creative dualism between art and science in the work of: Leonardo da Vinci (Grammatikakis 2005; Atalay 2006); the influence Einstein's ideas had on the work of Picasso (Miller 2001); as well as the strong projective geometry and visual arts found in the work of Durer (Panofsky 2005 in Arapaki and Koliopoulos 2011:799).

Science, technology and art coincide in the aims of Bauhaus, a 1920s art school in Germany that aimed to reunite art and craft to produce functional products with artistic merit ([http://www.metmuseum.org/toah/hd/bauh/hd\\_bauh.htm](http://www.metmuseum.org/toah/hd/bauh/hd_bauh.htm)). The school's philosophy was to combine art and industry which points to the merits of interdisciplinary collaboration. Bauhaus was influential in modern design: art, architecture, graphic design, interior design, industrial design, and typography. It emphasised the relationship between usefulness and beauty. Merging craft tradition with modern technology and integrating aesthetics, colour, industrial design and architecture was a feature of this mode of design which reflected a unity of the arts.

Sharrat (2013) comments on the way art and science connect in digital technologies. The importance of creating technologies that are also aesthetically pleasing was elaborated in an argument by Steve Jobs (Tessandier 2013) who believed that to create true technological innovation you need a mix of technology and liberal arts. Wilson (2002) claims art and science inform each other. Science and technology can be seen as cultural creativity and commentary, much like art. He comments that prior to the Renaissance Science was named "Natural Philosophy." Artists and scientists are seen as creatures of culture, and their work is understood within larger psycho-political-economic-cultural frameworks. There is an increasing level of artistic activity, for example, using computers, and the Internet. Many artists are working with scientific and technological research. Cultural theorists, art historians and artists have begun to write about many issues in techno-culture. "At various points in history, charcoal, paints, sculpting tools and techniques, ceramics, and printmaking apparatus were state-of-the-art technologies" (Wilson 2002:9). Wilson argues the power of artistic work derives partly from the cultural act of claiming it for creative production. There is video art, electronic music, laser art, and holography. Science fiction, literature, cinema, TV have mutual influence between science and art. In addition, computer graphics animation, 3-D modelling, digital video, interactive multimedia and Web art are now mainstream, as are computer graphic visual effects. Working artists with emerging technologies and those inspired by scientific enquiries are lumped together. Artists discover subtle properties of matter, while technology has utilitarian goals and scientists have abstract knowledge.

Wilson (2002) argues that today there is an expanding inclusiveness of the definition of art. Use of unorthodox materials, tools, ideas inspired by science and technology, some in non-art contexts: laboratories, Internet or the street. Artists who work at the frontiers of science and technology seek to move the definition of art. In Einstein's (1918) *Principles of Research* he stated that the artist and the scientist each substitute a self-created world for the experiential one, with the goal of transcendence. Both artists and scientists can be regarded as "creative interdisciplinarians" (in Wilson 2002:17). If this link is understood by students then their creative potential as well as their capacity to conceptualise explanatory frameworks in theoretical ways can embed meaning in their works.

### **Mathematics and Art**

While art and mathematics are usually seen as different domains (Coppel 1994), in fact the links between mathematics and art are extensive and students who undertake both subjects learn to appreciate the impact each discipline has on the other. Kappraff (2002) discusses the "constructive activity of creating designs based on mathematical principles" and explores the interface between art and mathematics. She examines ideas, constructions and discoveries of artists, architects, crystallographers, chemists and structural biologists stimulated by geometrical thinking. For example: tilings, origami, quasicrystals, Islamic patterns, and zonogons are all based on mathematical concepts. Sazdanovic (2012) examines tessellations in Persian art and kilims, tapestry woven carpets, which are full of symbolism from Byzantine, Greek, Chinese and Turkish traditions, and include patterns and symmetries which have relevance for mathematical analysis. Likewise, Stix (1995) looks at the relationship between visual imagery and mathematical problem solving. He states that

art has a place in the craft of mathematics as it has the potential for stimulating creative expression.

It is also interesting to note that knots play a prominent role in art history according to Sazdanovic (2012). Different kinds of knots: Chinese, Celtic, and those included in the work of Leonardo da Vinci can be constructed using graphs and are visually artistic. The principles of knotting can also be applied to tiling. Sazdanovic demonstrates how polynomial variants are used to create artworks. More recently there has been discussion of the impact and development of fractals (Short 1991) which “fracture coherent mental images of reality” (Coppel 1994:204) and lead to a new conception of aesthetics. Such innovations are part of new media art as they required the development of computers to construct irregular curves and shapes using algorithms.

Mathematical connections to art can also be made in the use of catenary curves, studied by Galileo in 1564 (Kaplan 2009) which occur naturally when a chain is allowed to hang. The Gateway Arch in St Louis uses a catenary curve as a sculpture and to demonstrate the engineering and artistic elements of its design. Peterson (1992) argues that being able to visualize mathematical processes is beneficial to graphic artists and that a growing number of artists find inspiration in mathematical form. Likewise, mathematicians can better understand patterns and relationships when they appreciate art. Geometry, sculpture, computer art and architecture are all fruitful areas of artistic endeavour. In fact, projects in art can help students make sense of shape, symmetry, similarity and geometric transformations (Stump, Clark, Mitchell & Roebuck 2008). Harkness (2007) reports on the training of pre-service teachers where a quilter was brought in to instruct them on geometry and measurement to help them understand real world contextual problems as mathematical activity. Research on African American weavers, quilters and seamstresses has revealed aesthetically pleasing mathematics chains and the incorporation of complicated mental effort and problem solving in their work. The longstanding tradition of quilting in American culture where it serves both utilitarian and artistic purposes is discussed by Rushman (2012) and Westegaard (1998) who comments that quilts are useful, visually appealing, steeped in history, an integral part of culture as well as a source for mathematical investigations.

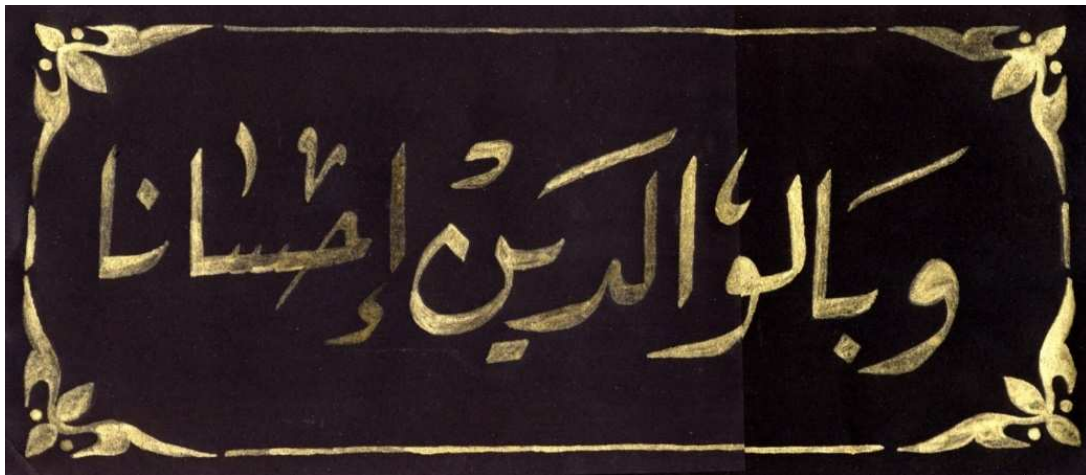
The term “ethnomathematics” (Harris 2003:2) has been coined to account for the abundant mathematical content of African American and non-Western cultures. Harris’s article discusses the “hard math” used in the African American quilting tradition which specializes in “evenly symmetrical designs” (2008:3). The art of creating a quilt requires precise calculations and measurements within freeform design. The “math chains” of quilts are also exemplified in woven baskets and handbags of Southern Africa. Harris comments that “fractals”, or recursive geometric patterns, are often found in the visual culture of African women, from cornrow hair designs to patterns carved on calabashes (2008:4). The work of Gloria Gilmer (1997), an originator of ethnomathematics, the study of mathematical ideas in cultural practices of a people, on design strategies of braiders has been used to interest students in mathematical concepts such as tessellations, hexagons, polygons, square and equilateral triangles.

The work of Hameed Aqbaly shows a connection between mathematics and art where he bases his style on traditional decorative design used in sacred texts and applies mathematical precision to the form and structure of his art. This particular text is rendered in *Kufic* style, used before Islam, and became the only script used for copying the Holy Quran for three hundred years. The use of blue and red used in this text is very traditional. Design is paramount. Letters can be stretched or contracted to allow for flowing decorative forms to fill spaces in the text (Samarayi 2006) and are inherently mathematical in their design and composition.



Hameed Aqbaly, *Islamic Calligraphy*, 1m. x 1.5m. Acrylic on Paper, Liverpool, NSW, 2003

Research into calligraphy from historical records and mathematical analysis shows that “fractal expressions” may have been used at least 1,000 years ago in ancient Chinese calligraphy (Li 2008). Artists who use this technique are broaching the boundaries between several disciplines.



Hameed Aqbaly, *Islamic Calligraphy*, 1m. x 1.5m. Acrylic on Paper, Liverpool ,NSW, 2003

### **Business, Management and Art**

Students in the Visual Art Enabling program combine business and management principles in their end of semester exhibition. Their portfolio is a valuable resource and is also necessary to validate entry to a Fine Art degree. Staging the exhibition requires fundraising through sale of raffle tickets for prizes donated by the campus bookshop. Students also have to organise food, design the invitation and poster and curate the exhibition. The evening is an important interface with the public and demonstrates how such an event must be carefully planned and executed using business principles. For example, effective management of the audience is required at the exhibition. There is a program to follow where guest speakers, course lecturer and students all contribute to opening the event.





The connection between business and art is clearly evident in street art, where artists deal directly with the public to sell their creations. While street art is sometimes viewed as a countercultural activity, in fact, as Borghini et al (2010) argue, it constitutes commercial communication. According to *Art Monthly Australia* (2013) over the past decade, street art has been “co-opted by popular culture to become the most mainstream contemporary art practice”. It is a source of absorbing and defusing radical ideas into mass media culture. Street art aesthetics are used in advertising which is designed to appeal to consumers. The “Outpost” Festival in Melbourne has become a premier tourist attraction which has flow on effects to other business enterprises in that city. Art, business and management are intricately linked, not least of all in the development of business enterprises such as *Snazzy Art Parties Limited* reported in *Daily Mail* (2014), learning about the connections is a useful part of foundational education.

### **Conclusion: Interdisciplinary potential of Art**

As an enabling subject, Visual Art is uniquely placed to deliver a taste of different disciplinary approaches. An interdisciplinary approach should be an organizing principle of curriculum (Arapaki and Koliopoulos 2011). Visual Art is not just about providing expression for practical creative potential. “Visual arts skills and knowledge are increasingly important to education in all disciplines” (Sandell 2011:52) and introduces enabling students to a range of important learning outcomes such as critical thinking and problem solving. It links students to other disciplines in a myriad of ways. Fleischmann and Hutchison (2012) state that multidisciplinary teams are now increasingly the norm in creative arts practice and are highly beneficial as they present possibilities for creative arts industries. In the tertiary sector areas such as IT, Business and Journalism are incorporated to provide broader rationales for student learning. This initiative is a response to contemporary workplace realities. Fleischmann and Hutchison (2012:23) argue that new students need to be positioned to become versatile and adaptable professionals who seek alliances within and external to the creative arts. They state that intersections of professional practice where people look beyond the scope of their disciplines and search for new alignments is vital (2012:24).

The value of studying Visual Art at the enabling level allows students to “develop enhanced visual communication and thinking skills, leading to multiple forms of literacy” (Sandell 2011:52). Sandell (2011:53) argues that proactive learners are transformed and become learners for life. Visual Art fosters “interdisciplinary connections and inspires deeper inquiry” (Sandell 2011:52), and also recognizes “the ways in which art informs other disciplines” (Sandell 2011:53). In its connections with history Rabb and Brown (1988:6) comment:

*As the examples multiply of interdisciplinary studies that rely on the skills of both historians and art historians to provide new insights into the significance*

*of visual artifacts, it will become apparent that this is indeed an essential means of enriching both disciplines, and thus our ability to explicate the past.*

Exposure to the knowledge of other disciplines encourages an interchange of ideas; fostering of debate; building bridges between individuals and disciplines, which acts against “silo mentalities” of disciplines (Fleischmann and Hutchison 2012:24-25).

This paper has discussed the interdisciplinary potential and pedagogical benefits of studying Visual Art where the question “Does art make you smart?” is answered in terms of mastery of new cognitive abilities and attention to networks in the brain creating cultivated minds. Research indicates that motivation and cognitive improvement are stimulated by art and that independent and critical thinking skills are enhanced in artistic production. Another pedagogical benefit of art was in teaching and learning how to interpret and decode visual images, a vital skill in understanding the world around us. Art also links people to their past by clarifying and explaining historical events. In some instances, art provides valuable records of the past that are no longer available in other forms. Art can also mystify the past, but provides a means of determining perspectives, both past and present, as exemplified in Indigenous art. Connections to philosophy are evident in that many famous philosophers were also interested in art and used it as an explanatory tool to guide reflective practice and enrich the quest for knowledge. Art provides sociological insights into all facets of the social world: gender, race and ethnicity, inequalities, habitus, to name a few, so the reciprocal nature of these disciplines and their capacity to inform each other is evident. Anthropological awareness of symbolism, mythology and cultural and social constructs helps students see the contexts in which images are framed as well as providing an interpretive assemblage.

Other useful interdisciplinary connections referred to in this paper are those between art and politics where art can be used as a creative expression of intolerance or as an ideological tool. The connections between art and literature, most evident in children’s picture books, but also in shape poetry, demonstrate the aesthetic qualities of words and also demonstrate the impact of imagery to creative expression. Art can also be linked to psychology where an extensive literature exists on the healing qualities of art therapy. Modes of meaning and understanding can be gleaned from an examination of emotional and behavioural capacities as well as an understanding of mental processes of artists.

Art has been shown to have epistemological similarities to science and technology where the need for pictorial representation as an explanatory tool, use of digital technologies and spectroscopy encapsulates commonalities of elegance and beauty. Many artists such as impressionists relied on scientific knowledge of light to inform their works. Likewise, many artistic designs are based on mathematical principles: patterns and symmetries, problem solving, geometric aesthetics. Calligraphy, knotting, braiding, tiling, basket weaving, quilting are areas that combine the skills of both art and mathematics. And art can be taken into business and management where both sets of skills are required for curating and organising exhibitions. Likewise, business skills are required for the successful occupation of creative pursuits such as street art. As an enabling subject Visual Art opens up so many possibilities to new learners and, as Parsons (1994:8) suggests, has the potential to become a curriculum leader because its capacity to introduce students to a range of discipline areas they can take up in more depth as undergraduates is unlike any other subject.

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