2005

The role of the artist at the beginning of the twenty-first century: An exploration of dialectical processes in art and science with particular reference to biologically based art

Judith D. Roche

Edith Cowan University

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The role of the artist at the beginning of the twenty-first century: An exploration of dialectical processes in art and science with particular reference to biologically based art.

Judith Diane Roche
Bachelor of Arts (Visual Arts) with Honours
Faculty of Regional Professional Studies
Edith Cowan University

Thesis presented as fulfilment of the requirements for the award of Doctor of Philosophy (Interdisciplinary)

Date of Submission: 19-08-2005
USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.
ABSTRACT

The role of the artist at the beginning of the twenty-first century: An exploration of dialectical processes in art and science with particular reference to biologically based art.

This thesis examines the role of the artist at the beginning of the twenty-first century. It focuses on the interaction between art and science in an exploration of the dialectical processes that may occur in that interaction.

Researchers have recently developed techniques in stem cell technology and genetic modification that offer remarkable potential and bring possible advantages and disadvantages for scientists and the wider community. In response to these new technologies, scientists and artists have developed collaborative projects and, in some instances, artists have moved from the studio to the science laboratory to create work called sci-art, bio-art, or moistmedia. This new inter-disciplinary activity affords prospects of dialectical processes: it crosses many boundaries and disturbs some existing conventions and practices, and, for the artists involved, the access to innovative materials has moved their work into areas of new skills and concepts. The extent to which traditional artists and those with collaborative sci-art practices contribute to the debate on important social and cultural issues forms part of this study.

The research data was gathered during semi-structured interviews with scientists and artists, of whom three scientists and five artists are involved in sci-art collaborations. Proposed dialectical processes identified in the data are outlined throughout the document.

A discussion about the ways in which contemporary art and artists are located within the current social and cultural environment; the status accorded visual art education today; and the manner in which commentators and other members of the public regard the elements and functions of art, forms the initial framework. This is followed by an overview of biologically based art practices, worldwide, that provides a background for a discussion of sci-art collaborations. These collaborations are
initiated by a wide range of individuals and organisations and, according to the participants, the intentions of the originator or funding body have the potential to influence the outcome of the collaboration. The research explores possible conflicts of interest between the parties involved in these interactions, and any perceived implications for creative freedom.

The study also examines current attitudes towards the notion of creativity in science and art, the avant-garde, and the relevance of philosophy and theory in art practices. It discusses the extent to which technology influences the creative process, and highlights issues that augment, interrogate or philosophise about the role of the contemporary artist.

The research found that, although the notion of Snow's 'two cultures' still has supporters, there are more similarities than dissimilarities between scientists and artists. Although some instances of Hegelian dialectical processes were identified, the data residing in many of the participants' responses called for a more post-structuralist, non-linear approach to the dialectic as described by Jervis (1998), Janesick (2000) and others. In this way, the data drew attention to many complex issues and tensions that emanate from the interaction between art, science, technology, government and commerce, and the interaction between artists and the culture and society in which they live at the beginning of the twenty-first century.
DECLARATION

I certify that this thesis does not, to the best of my knowledge and belief:

(i) incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education;

(ii) contain any material previously published or written by another person except where due reference is made in the text; or

(iii) contain any defamatory material.

I also grant permission for the Library at Edith Cowan University to make duplicate copies of my thesis as required.

Signed: [Signature]

Judith Diane Roche

Date: 19-08-2005
DEDICATION

To my living treasures Shon, Tanya, Ella and Jesse,

and

in loving memory of my elder son
Rod Fry, PhD
ACKNOWLEDGEMENTS

Dr Lorna Kaino, as principal supervisor, has guided me through this research process with academic rigour, encouragement, patience, good humour and kindness, and I offer her my sincere gratitude.

I also thank Dr Anthca Hill, my associate supervisor, for her feedback, insightfulness and support.

My son, Shon, has played a central role in my academic journey through his positive response to, and encouragement of, my first tentative steps towards a mature age education. I thank him for his continued support.

This research would not have been possible without the research participants and I wish to record the co-operation and enthusiasm they brought to the interviews. Their willingness to give of their knowledge, energy and time was sincerely appreciated, particularly in view of their professional commitments. Also, I wish to acknowledge the assistance of Dr Stuart Bunt in facilitating an introduction to Dr John McLachlan which resulted in an important interview for the research.

To the friends and colleagues who provided encouragement, support and comment during this study I offer my sincere thanks: June Anderson, Robert Cleworth, Dr Julie Goyder, Mary Hiscox, Emily Hugues-Dit-Cites, Anne-Marie Lapinski, Josh Ledger, Debbie Micallef, Yvonne Nistrzeba, Deborah O'Sullivan, Dr Ken Robinson and Helen Seiver. In particular, I wish to thank Victor Nicoli whose interest in the research, and probing questions about its subject matter, provided me with the opportunity to verbalise my arguments and thus to clarify my thoughts.
ARTIST’S STATEMENT

Tuart Fragments Series – 2005

The plates in this thesis are prints of segments of paintings from my Tuart Fragments Series, a series created using the leaves from tall Tuart trees (Eucalyptus gomphocephala). The Ludlow ‘Tall Tuart’ Forest, which is located a short drive south of Bunbury in the south west of Western Australia, is the last remaining tall Tuart forest in the world and a reminder of an ancient forest habitat. The paintings explore the beauty and attributes of these vital components of the Tuart forest, and the leaves used in the creation of the work were gathered from private ground prepared for fire breaks. Symbolically, during the creative process, the leaves fragmented.

Approval has been granted recently for mineral sand mining to occur in 115 hectares of the Ludlow ‘Tall Tuart’ Forest amid concerns that the tall Tuarts are difficult to regrow in mined soils. In addition, recent surveys have discovered unique subterranean fauna, stygofauna, within the mining lease. With this work I seek to encourage scientists and artists to work together on projects, such as the long term rehabilitation and conservation of the Ludlow Tuart Forest and its ecosystem, to achieve sustainable outcomes to the benefit of all.

Judith Roche.
March 18, 2005.
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INTRODUCTION

Our body is not in space like things; it inhabits or haunts space.
(Merleau-Ponty, 1964, p. 5)

Many artists inhabit a space where interrogation, experimentation and expression are constant companions, but their personal and professional lives are also impacted upon by the social, cultural and political milieu in which they live. Artists express diverse responses to these multiple influences, and their responses are indicative of the numerous ways artists situate themselves in the art world and in society in general.

Scientists, too, inhabit a space where interrogation and experimentation exist, and scientists and artists who collaborate in art and science based projects are among those who are beginning to extend the possibilities within this space, and to build bridges between science and art. After the Renaissance, many western countries adopted strategies of specialisation and viewed science and art as separate disciplines. Although there are many essential differences between the two professions, this thesis will argue that science and art are not discrete disciplines, and that they have areas where constructive intersection is possible, and does, indeed, occur. To this end, it examines the role of the artist at the beginning of the twenty-first century, and focuses on the interaction and possible dialectical processes between art and science, with particular reference to biotechnologically based sci-art practices.

Public institutions and private corporations have recognised the potential of linking science with art, and some laboratories now host collaborative activities to encourage exploration in various fields, such as sound, light, artificial intelligence, virtual reality, nanotechnology and aspects of consciousness. Traditional artists also engage with, and interrogate, the products and implications of new technologies.

The categorisation of artists or scientists, or their professional activities, is not usually helpful, in my view, nor would I choose to adopt such a practice in the normal course of events. However, in order to establish a workable structure and
scope for this research, and to gather data suitable for analysis and comparison, it was necessary to identify some form of groupings of art and science practitioners. The artists referred to as traditional artists are those with a professional art practice based on a conceptual and/or intellectual engagement with, and interpretation of, their subject matter, and who express that engagement with the use of traditional materials or contemporary adaptations of those materials.

The practices of scientists and artists working in wet laboratory environments who were selected for this study provide a cutting edge and challenging area for research, and establish a counterpoise between traditional and technology based art, generally referred to as 'new media'. Many of these collaborative scientists and artists engage with recently developed techniques and substances associated with stem cells, bacteria, tissue engineering, and other new scientific and medical advances. The terms used to differentiate these biotechnologically based collaborative practices from other forms of new media are sci-art, bio-art, and moistmedia.

Discussions with visual art students, lecturers and fellow art practitioners prompted me to question what constitutes the role of the artist at the beginning of the twenty-first century, and the relevance, manner and extent of the contribution contemporary artists make to the societies in which they live. To this end, I interviewed six scientists and six artists, as well as two artists who work together in a combined project, to establish the primary data for the research. Although ethical issues surrounding stem cell technology, genetic modification and other biotechnological advances impinge on sci-art practices, my study does not address these matters as bioethics is a burgeoning discipline in itself.

The semi-structured interviews enabled the participants to canvas issues pertinent to their professional lives that augmented, advanced and widened my inquiries, and afforded insights into possible dialectical influences. Although I apply the Hegelian triadic formulation of the dialectic in this study, I also use a more post-structuralist and non-linear approach to the dialectic as explained by Jervis (1998), Janesick (2000) and others in Chapters 1 and 2. Each chapter concludes with a comprehensive summary that includes a discussion of the participants' responses, an indication of the potential instances of dialectical interaction that emanate from those
opinions, and the integration of the interview data with the theoretical framework established for this research.

In view of the prime importance of the participants' observations from the interviews, their comments appear in Arial font to differentiate them from the quotations from the literature and other commentators, and, in order to give the interview data a sense of immediacy, I have used the present tense, except when the participant is referring specifically to the past. Comments from the participants that do not derive from the interviews appear in the standard typeface and are referenced separately. The dates of the interviews appear in Chapter 3. The topics discussed in each chapter derive from the participants' responses to the interview questions, and the relevant additional subjects they chose to introduce. Many of their responses apply to multiple topics and, where this occurs, cross references are provided to other chapters of the thesis. Due to the frequency of new developments occurring in new media and sci-art, and to keep the research current, where appropriate the participants' comments are complemented by reviews of the latest publications.

Chapter 1 addresses the methodology and the methods that underpin the research. Critical qualitative inquiry incorporates post-structuralist and eclectic approaches, and facilitates a search for patterns and dialectical influences within the interview data. It also provides for the use of data from sources other than primary interviews, including exhibition reviews, artist statements, conference and seminar papers, and the internet.

The Literature Review, Chapter 2, provides a background to the research topic, and subjects linked to it, including art and the artist, creativity and conceptual thought, the dialectic, and science and the scientist. The section on art canvasses a range of views from the mid-twentieth century onwards, on the quintessential characteristics and function of art, artists and art practices. The review thus establishes a background from which to appraise the participants' understanding of the role of the artist from the mid-1990s when sci-art collaborations began to receive wider attention. The connection between creativity and conceptual thought, and art and science, is discussed briefly. As the dialectic forms a major part of the data analysis, the literature review addresses historical debates and more recent opinions on the structure, processes and application of the dialectic. The segment on science relates to the role of contemporary scientists in connection with interdisciplinary
collaborations, and the recent proliferation of books about scientists. The literature review was undertaken prior to the commencement of the interviews and, therefore, does not cover all the topics raised by the participants. These additional topics are addressed in the relevant chapters throughout the thesis. The processes and products of the literature review research informed the compilation of the interview questions.

Details of the special attributes the participants bring to the research, and information about their art practices, or art works associated with them, appear in Chapter 3. Chapter 4 examines the situations and ideas that influence contemporary art practitioners, and the ways in which they adapt or manage those issues. Recent trends in the tertiary education of visual artists attracted comment, and prompted discussion of the benefits or otherwise of a visual art training in acquiring skills in innovative thought. Other subjects broached range from the aesthetic to the practical, and include beauty, fashion, the essence of art, the polymath, and the influence of gallery owners, auction houses, dealers and collectors. In this thesis, the aesthetic is referred to in relation to responses to art practice and the discussion does not incorporate an in-depth articulation of aesthetic theory or considerations which would warrant a separate thesis.

A description of selected examples of world-wide biologically based art practices appears in Chapter 5. The chapter also refers to concerns expressed, in some quarters, regarding recent biotechnological and medical developments, and the perceived lack of exhibition opportunities and curatorial frameworks for sci-art.

Chapter 6 examines scientist and artist collaborations, and the motivation and aspirations that foster these interactions. One matter raised here is the possible influence outside agencies could have on the collaborative partners, and the level of control or discretion the partners have over the outcomes of their creative endeavours. In addition, the participants discuss issues concerning ways in which institutions, corporations, or others, could attempt to appropriate art to aid the cause of science, and/or to enhance an organisation's public profile. In so doing, Chapters 5 and 6 establish an overall picture of contemporary sci-art practices.

Chapter 7 provides an overview of the government and corporate funding regimes that impact on both sci-artists and traditional art professionals. The establishment of institutions to support new media art has assisted in the promotion of digital and biotechnological collaborations, and a wide network of related
conferences and exhibitions has been formed. The participants have varying views on whether funding could bring with it implications for freedom of practice or conflicts of interest.

Chapter 8 moves into the field of creativity and examines the participants' views on the extent of the relevance of problem seeking and problem solving skills to both scientific and artistic endeavour. It reviews any perceived impacts of governmental or institutional policy on creativity in traditional art and sci-art practices. Participants assess the interaction between technology and scientific and artistic processes, and discuss the degree to which technology drives creativity, and the contribution, if any, of intuition and serendipity.

Chapter 9 analyses attitudes towards philosophy and theory in current art practice, and examines whether participants believe knowledge of these subjects assists artists in the creation of engaging and challenging art work. Some participants question whether the new technologies are driving philosophy rather than philosophy driving contemporary thought.

Chapter 10 questions the extent of the relevance of an avant-garde in the art world at the beginning of the twenty-first century. In particular, the participants discuss which contemporary art and sci-art practices could, in their opinions, be regarded as avant-garde.

Chapter 11 discusses the diverse facets of the role of the artist. These facets incorporate the role of the inquiring artist, and the extent to which informed artists are able to visualise concepts not previously visible. Participants also express their disappointment with inaccessible and elitist didactic panels and art work. This chapter also evaluates the issue promoted by several of the participants: the significance or otherwise to artists of an ability to assess the 'discards'; the 'in-between', the information overlooked or discarded by others which, in new hands, could become specks of 'gold dust'.

The participants were generous in the time, energy and consideration they gave to the interview process and it was impossible to reflect all that they communicated in a study of this nature. The topics included in the thesis, therefore, are those that were mentioned with concern by the majority of the participants, and
those that opened up avenues for exploration, evaluation, and ideas and opportunities for further research.
CHAPTER 1

METHODOLOGY

All perceiving is also thinking, all reasoning is also intuition, all observation is also invention. (Arnheim, 1974, p. 5)

Introduction

This chapter describes the methodology, methods and ethical issues that inform my study. The methodology is broadly defined as a critical qualitative approach (Denzin & Lincoln, 1998, pp. 26-27). The prime concern of my research is to investigate the role of the artist in the cultural and social environment at the beginning of the 21st century. This approach enables me to understand the meaning people give to a particular social phenomenon (Greene, 2000, p. 988), and opens ways to explore any dialectical impacts on the role of the artist concerned with developments in science and technology.

The key components of the critical qualitative methodology used in my study draw upon Lather’s explanation of ‘methods’ and ‘methodology’. Method, as Lather (1991) explains, "refers to techniques for gathering empirical evidence", while methodology “is the theory of knowledge and interpretive framework that guides a particular research project" (pp. 3-4). These basic elements of a research process, are further explained by Crotty (1998) as

*Methods*: the techniques or procedures used to gather and analyse data related to some research question or hypothesis. *Methodology*: the strategy, plan of action, process or design lying behind the choice and the use of particular methods and linking the choice and use of methods to the desired outcomes. *Theoretical perspective*: the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria. *Epistemology*: the theory of knowledge embedded in the theoretical perspective and thereby in the methodology. (p. 3)
In accord with Crotty, Lather, and also Harvey (1990), who states that "methodology is viewed as the interface between methodic practice, substantive theory and epistemological underpinnings" (p. 1), the data gathering and data analysis processes for this research reflect the philosophical foundation established in the methodology.

"Exploration, discovery, and inductive logic" are key elements of qualitative enquiry, according to Patton (1990, p. 44), supported by Holstein and Gubrium (2001). Specifically, the critical qualitative methodological approach of this study draws on post-structuralist ideas that see inquiry "as a relative undertaking shaped by discursive and interpretive practices" (Mirriam-Webster OnLine, 2004), and an approach that can also incorporate ideas from critical, modernist, neo-Marxist perspectives, to gain an insight into the participants' perspectives.

I do, however, take note of Patton's caution that, when using an eclectic methodological approach, "What is required is that the researcher be very clear about the theoretical framework being used and the implications of that perspective on study focus, data collection, fieldwork, and analysis" (1990, pp. 86-87). [Italics in original.]

Before describing in detail the key components of the methodology and methods for this study, I want to briefly locate myself as a researcher to provide an insight on how my philosophical orientation and values inform the methodology for this research.

**Locating the researcher**

My Honours dissertation and art work explored the topic *Science @ art: When art, chaos and fractals collide*. This area continues to influence my thinking, painting and printmaking. In view of this interest, and notwithstanding the theoretical arguments outlined above, I experience great difficulty in accepting narrow constraints that conform to rigid theoretical paradigms, although I acknowledge the value of these paradigms in the construction of patterns for research, thought, and argument. Therefore, while recognising that the prevailing practice is to locate research within theoretical parameters, a practice which has been followed in this discourse, my art and lived experience inform one another. If categorisation is
necessary, I favour post-structuralism, a more eclectic approach which Gubrium and Holstein (2000) suggest suffuses "constructionism with cultural, institutional, and historical concerns" (p. 487).

Another motivation for conducting the research comes from working with students in the visual arts. Some students express concerns regarding their future role in the prevailing climate of rapid social change, and question where art fits into the scheme of things. Although my research investigates some of the issues surrounding their concerns from a contemporary standpoint, a definitive answer is elusive.

My research involves areas of both long tradition, and change associated with new technologies. Accordingly, I have developed my methods to work with the data in a timely and efficient manner in order to heed the following warning to researchers:

Yet, with the global proliferation of communication technologies in particular, processes of meaning making are also accelerated. Values, attitudes, and opinions are all subject to rapid fluctuation, and with them patterns of related action. In effect, the temporal relevance of a research study is increasingly circumscribed, and the half-life of cultural analysis increasingly shortened. (Gergen & Gergen, 2000, p.1040)

**Incorporating a reflexive approach**

Smyth (2000) defines the term 'reflexivity' as that which describes the manner in which the researcher reflects on the relationships that operate within the research process. These relationships include those between theory and data; the researcher's presence and the data; and organisational and cultural structures and the data (p. 61).

The need for interviewers to bracket their own views or dispositions is emphasised by qualitative researchers. According to Willis and Smith (2000), the researcher's pre-existing views could influence the data by privileging some information over other phenomena, as it is revealed by interviewees (p. 10). Holstein and Gubrium (2001, passim) suggest that interviewers approach aspects of interaction in the interview process positively and capitalise on the opportunities that the interaction may present. They also need to be aware that the knowledge produced is "inevitably limited by our own histories and the institutional forms within which
we work” (Simon & Dippo, 1985, p. 200). Kincheloe and McLaren (2000) advise researchers to acknowledge any existing social and political affiliations and “understand their impacts” on their interactions with participants (p. 288). I anticipate that an eclectic approach will assist me to reflect on the impacts identified above.

One implication of quantum theory, a subject explored in my Honours thesis, implies that the involvement of the researcher or observer is sufficient, in itself, to impact upon the dynamics of the interview or interaction and thus the research data. “Nothing can be seen in isolation, for the very act of observation must involve coupling of some sort” (Davies, 1990, p. 57). Chaos theory presents other implications and challenges for qualitative research, for it “challenges our need for order and prediction, even as it offers new ways to fulfil those needs” (Patton, 1990, pp. 82-83). Aspects such as iteration and non-linearity encourage a wider, boundary-free approach to our world view and suggest to researchers that characteristics such as turbulence, complexity, and chaos can contribute useful metaphors and concepts to their interaction with interviewees and data. This wider world-view is important in respect to my research as I am interacting with scientists and artists who are working with the latest biotechnological developments and who are confronting complex and controversial issues. In contrast, comments by some participants indicate that they are sceptical about the continuing relevance of artists whose practices include, but are not limited to, more traditional media.

This shift in understanding, partly prompted by new insights into the role of the observer as outlined, has brought the concept of reflexivity to research. According to Hertz (1996), reflexivity requires “self-analysis and political awareness” and “permeates every aspect of the research process” (p. 5).

An eclectic approach admits a broader lens to critical qualitative inquiry. Eisner (1997) examines emerging theories of qualitative research, such as arts or narrative based research, from the viewpoint of “the promise and the perils they present” (p. 259). He notes that “fine art is the quintessential achievement of creating congruence between form and content in the telling” (p. 264). That may be so, but I feel compelled to observe here that subjectivity is a force to be reckoned with in assessing what fine art has or has not achieved. Taylor (1987) argues that subjectivity in art has several guises and, in modernist art, can mean “private, inward-looking,
and relevant only to the artist or his [sic] group" (p. 7). Taylor also states that the subjectivity of technique is also vital to our understanding of art and to the issues it presents (p. 17). Therefore, during the analysis and discussion of the participants' artwork, I maintained a constant sensitivity to subjectivity and reflexivity. Returning to Eisner, the use of the dialectic as a theoretical basis for this study addresses some of the "perils" he outlines; for example, the question of ambiguity in any narrative-style data, and the issues of interpretation and persuasiveness on the part of the researcher.

One of the ways in which the social sciences address Eisner's perils is the technique of triangulation. My research incorporates instances of potential triangulation: data triangulation, the inclusion of interviews, documents, and observation; interdisciplinary triangulation, the inclusion of participants from science and art; and theory triangulation, the inclusion of more than one perspective of interpretation. However, to maintain a steady focus on the aim of the research, to accommodate the wide-ranging views of the participants, and to avoid categorisation, instead of using triangulation I have chosen to sustain a constant focus on thematic, pattern, and dialectical analysis as explained below. Due to the eclectic nature of the study, with no fixed point of reference, this better suits my purposes and concurs with Denzin and Lincoln (1994). In the preface to Richardson's contribution to their compendium, Denzin and Lincoln invoke her image of a crystal which she contrasts to a triangle:

Postmodernist, mixed-genre texts do not triangulate. The central image is the crystal, which ‘combines symmetry and substance with an infinite variety of shapes, substances, transmutations, ... and angles of approach.’ Crystals are prisms that reflect and refract, creating ever-changing images and pictures of reality. Crystallization deconstructs the traditional idea of validity, for now there can be no single, or triangulated, truth. (Denzin & Lincoln, 1994, p. 482)

In qualitative inquiry, Garman (1994) hypothesises that validity is achieved by assessing work through criteria of quality. Although she qualifies her proposal by recognising that research is judged by its disciplinary community, Garman lists verity, integrity, rigour, utility, vitality, aesthetics, ethics and verisimilitude as criteria for assessing the quality of the work (p. 7). These are qualities integral to my research, and the methods used are proposed in order to sustain this rigour.
Methodological approach

As stated, my research is located within the broad field of qualitative research/enquiry, which is methodologically eclectic and post-structuralist and, as such, provides for qualitative and critical approaches. It is also a useful methodology in assisting the researcher to understand the meaning people give to complex social experiences such as sci-art collaborations.

Before proceeding, I want to link my art background with my research into the relationship between art and science; a valid state of affairs, according to Lincoln and Denzin (2003, passim), as the field of qualitative research is interdisciplin ary, transdisciplinary, and sometimes counterdisciplinary. Dewey (1958), a modernist, marries art with the quotidian and suggests that it is the role of the artist to develop this close relationship. In this way, Dewey believes art can fulfill its essential role as a principal form of human communication (1958, pp. 104-105), a subject raised by many participants. Janesick (2004), referring to Dewey, believes there is a connection between "a critical approach to art as experience", the lived experience of the participants, and the qualitative researcher (2004, p. 11). She remarks that Eisner is influenced by Dewey, confirmed in Eisner (1985, passim), and interweaves their views to provide a summation of Eisner's notions of qualitative studies as; "field focused"; reliant "on the self as research instrument"; "interpretive in character"; reliant "on the use of expressive language and the presence of voice in the text"; attentive "to particulars"; and they "become believable and instructive because of their coherence, insight, and instrumental utility" (Janesick, 2004, p. 11).

The assumptions about critical qualitative research set out by Lincoln and Guba (2003) also place this methodology within a similar world view to that of Dewey and Janesick. They assume that:

- Ontologically, reality is subjective and multiple;
- Epistemologically, the relationship between the researcher and the participants is interactive; and
- Axiomatically, the research is value laden (Lincoln & Guba, 2003, pp. 256-265)

Although conceptually diverse and post-structuralist in orientation, my research also stands within a critical theory framework (Denzin & Lincoln, 1998, pp. 26-27) and incorporates modernist, neo-Marxist perspectives. For Smyth (2000),
critical qualitative research represents a "simultaneous process of 'deconstruction' and 'reconstruction'" (p. 57). Harvey (1990) contends that the use of "a critical-dialectical perspective" underpins critical research (p. 1) and that "the aim of a critical methodology is to provide knowledge which engages the prevailing social structures" (p. 2). According to Giroux (1983), the Frankfurt School's perspective on critical thinking has created

a valuable epistemological terrain upon which to develop modes of critique that illuminate the interaction of the social and the personal on the one hand, and history and private experience on the other. Through this form of analysis, dialectical thought replaces positivist forms of social inquiry. (p. 29)

The Frankfurt School is the name by which the Institute for Social Research, founded at the University of Frankfurt in 1923, is known. Many of its members became exiles in New York during WW2 and returned to Germany in 1949. The School developed a critical theory based on Marxism, opposed positivism, and recommended that "an open-ended and continuously self-critical approach could avoid paralysis in the theory, and therefore also in the practice, of social transformation" (Biddiss, 1999, p. 334). Critical theory still retains some modernist influences although its Marxist orientation has diminished over time.

A dialectical approach forms part of critical qualitative methodology as outlined by Kemmis and McTaggart (2000, passim) and Greene (2000, passim).

An important principle, if interesting interpretations are to be produced, is to think in a dialectic way. It is in the state of tension between different realized ideas and practices on the one hand, and alternatives to these on the other that it becomes possible to avoid getting caught by established ideas and institutions (Adorno and Horkheimer, 1979; Marcuse, 1964). By negating the existing order, it becomes possible to see it in a different and seminal way. (Alvesson & Sköldberg, 2000, p. 138)

Crotty (1998), too, favours the view that the dialectic allows that "reality can only be understood as multifaceted interaction" as distinct from a linear, causal relationship" (p. 118). To guard against "imposition and refutation on the part of the researcher", Lather (1986) suggests dialectical practices which "require an interactive approach to research that invites reciprocal reflexivity and critique". She notes that the neo-Marxist researcher sometimes adopts an "interpreter of the world"
and "exposer of false consciousness" stance and that this "nondialectical, nonreciprocal perception of the role of the researcher confounds neo-Marxist researchers' intent to demystify the world for the dispossessed" (1986, p. 265). Smyth (2000) adopts Lather's view that the dialectic provides a means to "clarify and reconstruct existing theory". He adds that it is also useful in challenging existing constructs (p. 56), an approach taken by this research in its examination of prevailing stereotypical myths about scientists and artists and its observation of how and where the participants locate themselves within the contemporary world view.

Further, Wainwright (1997) outlines the methodological consequences of the use of dialectical logic and advocates an awareness of the historical background of the phenomenon being studied, not only to observe changes in its appearance or form but to reveal the nature of the relationship between the phenomenon's appearance and its underlying essence.... The dialectical approach problematises [the] relationship between objective reality and our attempts to represent it in knowledge. Part of the problem is that objective reality is in a constant state of flux and our attempts to grasp it through categorisation and definition must inevitably become outdated or inadequate over time. The purpose of studying a phenomenon over time is, therefore, to reveal the historical specificity of phenomenal forms and the extent to which they are socially constructed. (Wainwright, 1997)

A critical social theory relevant in the twenty-first century is reconceptualised by Kincheloe and McLaren (2000) as "concerned in particular with issues of power and justice and the ways that the economy, matters of race, class, and gender, ideologies, discourses, education, religion and other social institutions, and cultural dynamics interact to construct a social system" (p. 281). These subjects are frequently targeted by serious artists and some have been addressed by interviewees.

Researchers have long sought to understand complex relationships, and the function of intertextuality is now recognised in the search for meaning. The search for the cultural and historical meanings interwoven in French social life was the subject of Barthes' *Mythologies* (1957). However, by the time he wrote *The Death of the Author* (1968), texts, including visual texts, were not examined in isolation, or as the sole product of a single author, but were approached as a result of a much wider network of influences both past and present. Such influences included the instability of meaning within the text itself. Derrida's work in semiotics, for which he borrowed
the term deconstruction from Heidegger, paralleled the hypotheses of Barthes, in that Derrida questioned the meaning between the sign, the signifier, and the signified, as well as the understanding of what is knowledge. According to Fuery and Mansfield (2000), Derrida insists that

> all knowledge has to take into consideration the cultural logic in which it is situated, the binarisms that it assumes, and the language, or systems of representation, on which it depends for its formulation. (2000, p. 62)

A response to deconstruction is post-structuralism, a stance that "is suspicious of truth and meaning, which it sees as a construct that often serves specific cultural or political ends" (Fuery & Mansfield, 2000, p. 62). Further, "every human practice, according to post-structuralism is conditioned by, indeed is part of, textual practice, and the logic of textuality must always be considered when we attempt an analysis" (Fuery & Mansfield, 2000, p. 63). These theories have relevance in this research programme because several forms of texts (data) are included in the process of analysis.

The ramifications of the texts by the French writers, Barthes, Foucault, Derrida and Baudrillard, were not confined to literature and theory. Around 1980, as Halley (1993) would have it, post-structuralist thought suddenly gained momentum among artists and prompted the "heralding and effecting [of] the sudden vanquishing of nature from this world of culture" (p. 1072). He maintains that two dominant trends have developed from the texts and wonders if artists and their audience "seduced by this shimmering world [of Baudrillard's surfaces] have not been deflected away from the investigation of crucial issues about society's structure [Foucault]" (Halley, 1993, p. 1074). The scientists and artists interviewed for this research address issues about society's structure, and the data is examined for any indication of a dialectical influence that may have prompted their interests and concerns.

Wilson (2002) contends that although critical theory, which informs critical qualitative inquiry, has provoked considerable thought about the interactions of "art, media, science, and technology" in cultural circles, the theorists' ideas have not been widely welcomed in the disciplines of science and technology. "In its rush to deconstruct scientific research and technological innovation as the manifestation of
metanarratives, critical theory leaves little room for the appearance of genuine
innovation or the creation of new possibilities”. He claims this “disjunction” poses
problems for biologically and technologically based artists (Wilson, 2002, p. 11).

Critical theorists see science as a modernist delusion. They see the
self-constitution of scientist/observer as a continuation of cultural
texts focused on domination and exploitation. They challenge the
possibility of objectivity, noting the pervasive influences of gender,
social position, national identity, and history. They focus on issues
such as the social forces and metanarratives that shape the questions
and paradigms used in inquiry; the role of socially constructed
frameworks at all stages; and the interaction of the observer and the
observed phenomenon. Radical constructivists doubt our ability to
discover truths applicable across all times and cultures. (Wilson,
2002, p. 12)

The disjunction experienced by Wilson is, in part, acknowledged by Smith
(1993) who identifies that, while one approach to critical research methodologies can
potentially be ‘emancipatory’, others merely provide a ‘critique’ (pp. 79-81). Wilson
suggests that the “interpretative tone of culture theorists stems from their experience
of being acted upon by new technologies, while the optimism of scientists and
technologists reflects their engagement in the processes of imagining, inventing,
developing, and enabling the new technologies” (Wilson, 2002, p. 23). He points to
contradictions he locates in the arguments of theorists from Postmodernism and
deconstruction, such as Saussure and Baudrillard, and indicates that it is essential for
others who follow those critical theories to resolve those contradictions (Wilson,
2002, p. 25). I do not share the antipathy to technology that Wilson attaches to
critical inquirers. The ways in which critical theory and Postmodernism impact on
artists, as Wilson describes it, are further discussed in Chapter 9.

Data collection methods

Preliminary research revealed that a significant number of contemporary
artists, critics, scientists, and philosophers are concerned with the role of artists in
relation to science and technology, and their place in the cultural milieu in which
they live and work. The following procedures were designed and adopted to establish
a semi-structured interview protocol, a tool of qualitative research, to canvas the
current views of artists and scientists about these concerns. A semi-structured
interview provides room for the respondent and the interviewer to address relevant additional features as they emerge from the dialogue. (Semi-structured interviews are elaborated upon below.)

Supplementary research data was derived from my observation of the participants and their art practices, and I collected documents, including journal articles, art critiques, conference papers, and media interviews, as explained in this chapter under Analysis of Documents and other Media.

Selection of participants

Interviewing élites* has particular methodological implications. Gould (1999) defines élites as those who “occupy a position (or positions) of superiority within a society or group by virtue of qualities (actual, claimed or presumed) of excellence or distinction” (p. 264). Because of the recognition accorded them by their peers, and the wider recognition they have received, I approached the research participants as members of the élite for the purposes of this study.

Hertz and Imber (1995), and Ostrander (1995), outline strategies for gaining access to and interviewing élites. However, Ostrander suggests that, contrary to general opinion, gaining access is less difficult than establishing ways to protect “the interests and integrity of the research and the researcher” (p. 135).

A purposive sampling technique was used to locate the initial interviewees in the fields of art and science. Interviewees were selected based on the level of Australia-wide and international recognition of their work. This recognition was determined by research into traditional and biologically based artists whose work is critiqued in peer reviewed journal articles, conference papers, newspapers, and catalogue essays; scientists who have collaborated with biologically based artists; and scientists who have not been involved in such collaborations. Twelve of the interviewees are based in Australia, and one collaborative scientist is based in the United Kingdom. “Snowball” sampling, to borrow Patton’s term (1990, p. 176), a technique similar to networking, resulted in the identification of McLachlan and Kuhaupt as potential participants.

Potter and Wetherell (1987) support the theory that a small sample size can elicit as much valuable information as a larger number of participants. Indeed, they contend that “small samples or a few interviews are generally quite adequate for
investigating an interesting and practically important range of phenomena” (1987, p. 161). Research data sources can include documents and other records as well as interview data, which mediates against including large numbers of participants (p. 162). The sample size reflects the experiences of Morse (1998, pp. 62-63), and the theories of Flick (2002).

I then identified thirteen participants who were formed into the following groups:

1. artists who have biologically based art practices and who address aspects of science, or scientific knowledge written for the general public, as part of their art practice (Peta Clancy, Patricia Piccinini, and Ionat Zurr and Oron Catts, who form the Tissue Culture & Art Project);

2. artists who have traditionally based art practices and who reflect on their role in contemporary culture (Jason Benjamin, Susanna Castleden, Robert Cleworth, and Richard Kuhaupt);

3. scientists who collaborate with artists in biologically based art practices (Dr Stuart Bunt, Dr Steve Meikle, and Dr John McLachlan); and

4. scientists who do not collaborate with artists in biologically or technologically based art practices (Joanne Edmondston, Dr John Long, and Fiona Nicholls). I need to record here that during the intervening three weeks between the setting of our interview appointment and the actual interview, Edmondston contacted Kuhaupt and another artist with a view to submitting a collaborative project proposal for funding. However, as the collaboration was in the preliminary discussion stage, I retained Edmondston in this group for my research purposes.

In addition, and at Edmondston’s suggestion, I contacted Kuhaupt and invited him to become a participant, although this increased the number of artists to seven. I felt his input would add another dimension to the research because Kuhaupt straddles the hypothetical divide between traditional and biologically based artists as his practice incorporates both fields, and because he is involved in collaborative projects which do not involve stem cell research per se.

I invited the participants to take part in the research interviews in person, by letter, or by email. The factors that influenced the method of approach included the location of the proposed interviewee, the level of my personal acquaintance with the
proposed interviewee, the method of contact suggested or put in place by a referee, and the proposed interviewee's prior knowledge of the intended research. I heeded Ostrander's warning (1995, p. 135) that gaining access to an elite participant did not equate with establishing a basis for trust within the interview situation, and took steps to inform interviewees about my role as researcher, the reason for and background to the research, and to obtain the necessary informed consent and agreements, prior to the commencement of the interview programme. Copies of the pro-forma Statement of Disclosure and the Informed Consent Form, as approved by the Edith Cowan University Human Research Ethics Committee and as provided to each participant, are attached as Appendices A and B respectively.

In view of their elite status within their fields, and the accompanying demands on their time, my initial request sought the allocation of one hour by the participant for the interview. However, interview times varied between 35 minutes (one) and 90 minutes (the majority) and depended on the depth in which the participant chose to engage with the subjects raised.

The interviews were conducted in a range of venues, the principal criterion being the convenience and comfort of the interviewee, or by telephone with participants from Victoria and New South Wales. The international interviewee, Dr John McLachlan, was brought to Western Australia from England by the University of Western Australia.

Profiles of the participants are provided in Chapter 3.

Semi-structured interviews

Interviews conducted with set questions enable researchers a greater capacity to compare responses on the same issues, and assist in the identification of patterns (Potter & Wetherell, 1987, pp. 163-164). Although I acknowledge there is validity in their claim, I defend my use of semi-structured interviews on the grounds that the diverse range of opinions that emerged in my research would not have been possible with a closed interview structure. If pattern analysis proved more difficult because of the diverse opinions, I was prepared to accept the challenge. Advantages that accrue in semi-structured interviews include the opportunity for both interviewee and interviewer to explore, where helpful, any stances taken, and any perceptions or experiences related by the participant.
However, Neal (1995) reports that she experienced some problems in retaining control of the process using a semi-structured interview approach in interviewing "up". While acknowledging the "ethical and political" necessity to "provide a framework allowing research respondents who inhabit powerless positions as much control over the interviewing process as possible, offering control of the process to research respondents who inhabit powerful positions represents a fundamentally different context" (1995, p. 523). Fortunately, I experienced no difficult situations in this regard during the interview process and this may have been due to the participants' enthusiasm for the research topic. Also, the interview questions were framed in such a way that participants were able to build on any particular area of interest to them that was relevant to the research.

Potter and Wetherell (1987) stress that, contrary to the concept that the interview is expected to reveal "an unbiased set of opinions", researchers engaged in discourse analysis prefer to conduct the interview in a conversational manner. This methodology requires that the interview questions be incorporated within the transcript as "the researcher's questions are seen as active and constructive and not passive and neutral" (p. 165). I followed their advice and included the questions in the transcripts.

To summarize – interviews in discourse analysis differ from conventional interviews in three ways. First, variation in response is as important as consistency. Second, techniques which allow diversity rather than those which eliminate it are emphasized, resulting in more informal conversational exchanges and, third, interviewers are seen as active participants rather than like speaking questionnaires. (Potter & Wetherell, 1987, p. 165)

I recorded the interviews on tape, with the consent of the participants, and transcribed them verbatim. The completed transcripts were sent to the participants for their amendment and approval. The majority of participants then returned the signed transcripts to me indicating their authorisation to use data from the transcripts in this thesis and other publications of the research. Others indicated their approval by email or by letter.

The first interview was conducted on the 9th June, 2003, and the final interview was conducted on the 9th January, 2004.
Interview questions

The interviews were constructed to address the primary research questions for the study. Therefore, they centred on the role of the artist, the interaction between art, science, and technology, the attitude of artists and scientists to sci-art collaborations, and the circumstances pertaining to art and science at the beginning of the twenty-first century. Although the participants were aware, from the research title, that dialectical processes formed part of my inquiry, I did not ask any questions specifically relating to the dialectic as I did not wish to precipitate pre-determined responses in that area.

The first two participants, Castleden and Cleworth, were not provided with the questions prior to the interview. They both commented that the questions were challenging and that they would have preferred a little time to consider their responses. Accordingly, all other participants were provided with the questions approximately two days prior to the interview, and, to maintain equity, Castleden and Cleworth were given the opportunity to submit additional comments when returning their approved interview transcript.

As anticipated in the choice of a semi-structured interview protocol, during the interviews other questions arose and were discussed, a situation which parallels Eisner’s (1999) observations that “in doing research of this kind [qualitative], you might not know what the questions are until you are well into the research” (p. 20). I would suggest that being observant of new questions or issues is essential to meticulous research, and items of interest that developed during the interviews formed additional discussion in this study. Some participants commented that the questions appeared asymmetrical at first, but all interviewees were asked to respond with their views of both science and art.

The interview questions are as follows.

Preambule: The last decade has seen an explosion of interest in the interaction between art and science. The Wellcome Wing of The Science Museum, UK; the CSIRO, Australia; the Australia Council; and universities, particularly in Europe, the USA, and Australia, have all initiated projects in this area. Generous funding allocated to these activities has enabled artists working in the many aspects of this field to choose a variety of responses. I would like to hear your views on the ways in which science and art have interacted, and the role of the artist at the beginning of the twenty-first century.
1. What circumstances, such as social, political, economic or other, do you consider may have encouraged educational and governmental organisations to instigate collaborative exhibitions between artists and scientists, and what are the impacts and implications for artists of this institutional intervention?

2. Competition for corporate research funding and sponsorship is strong. What influence do you think this situation will have on the ability of artists and scientists to retain the element of creativity necessary in explorative and interrogative practices?

3. At a time when the general public is sceptical about recent scientific developments, such as stem cell technology, and genetic modification of grains and other items destined for food products, why do you think artists have agreed to collaborate with scientists in the development of art works? And to what extent do you think contemporary professional artists, both traditional and new media, engage meaningfully and critically in these debates?

4. To what extent do you think science is appropriating art to navigate a path between the scientist and the public?

5. According to some theoreticians, creative scientists are imbued with problem seeking skills as well as problem solving skills. How would you value those skills as part of an artist's tools?

6. To what extent do you think philosophical or theoretical considerations influence art of all persuasions today?

7. Early photographers looked for connections with art history, and appropriated the framework of painting, to present their work and to launch claims for the recognition of their work as art practices. Artists with biologically based art practices claim that, when an exhibition of their work is proposed, difficulties arise due to the lack of criteria to form a context within which their work can be located. To what extent do you consider contemporary curatorial, art-historical, critical, economic or other practices are relevant to the presentation, evaluation and legitimisation of biologically based art practices? If you consider these practices to be relevant, what strategies could you suggest for their development or implementation?

8. Some commentators have suggested that technology is driving art and science rather than vice versa, and that this has changed the fundamental creative process. How do you respond to this?
9. The concept of the avant-garde was initiated in the 1830s by Saint-Simon who suggested that artists, scientists, and industrialists were the leaders who would take the French to a new social order. In the mid 1800s, the Fourierists confirmed Saint-Simon’s interpretation of avant-garde as having political and radical connotations, but, in the twentieth century, according to some theorists the term has been tied more frequently to aesthetic concerns. Keeping in mind Saint-Simon’s original intention that the term should indicate “radical or advanced activity in both the artistic and social realms” (Nochlin, 1991, p. 2), and the notion of a capacity to subvert society, do you think the term avant-garde applies to any contemporary art practices and, if so, which practices and how?

10. Plekharov maintains that an “art for art’s sake” practice, wherein aspects of meaning and purpose are unnecessary, derives from an artist’s feeling of disaccord with the social environment. Nochlin claims that an avant-garde art derives from a feeling of alienation. How do you respond to these hypotheses?

11. How would you summarise the role of the artist in today’s world? For example, what, in your view, are the responsibilities, if any, of a contemporary artist?

12. “The best art says things that cannot yet be put into words” (Allen, 1997, p. 12). Do you have a comment to make on this?

Data analysis process

Analysis is made up principally of two closely related phases. First, there is the search for pattern in the data. This pattern will be in the form of both variability: differences in either the content or form of accounts, and consistency: the identification of features shared by accounts. Second, there is the concern with function and consequence. The basic theoretical thrust of discourse analysis is the argument that people’s talk fulfils many functions and has varying effects. The second phase of analysis consists of forming hypotheses about these functions and effects and searching for the linguistic evidence. (Potter & Wetherell, 1987, p. 168)

After transcribing the interviews, I analysed the data into themes or subjects. Once all the transcripts had been deconstructed into relevant themes, I proceeded to sort each theme by patterns of discourse. These discourses were then subjected to scrutiny for instances of dialectical tensions. The documentary data was interwoven concurrently with the on-going interview data analysis to build the over-arching
concepts and contexts – the meaning-making component of my critical qualitative inquiry.

**Thematic, pattern and dialectical analysis**

In critical qualitative inquiry, content and thematic analysis methods are recommended in instances where the researcher is seeking not only the manifest content but also the latent content of the interview data (Sarantakos, 1998, p. 260), which, as Boyatzis (1998, p. 16) notes looks “at the underlying aspects of the phenomenon under observation. It is more interpretive than manifest-content analysis”. During some of the interviews, latent issues, such as curatorial dilemmas for biologically based art, became apparent as undercurrents of concern. These undercurrents are important in defining the dialectical tensions arising from the data and in reporting a comprehensive cover of the responses to the research questions.

In developing the content and thematic analysis, I found that the analysis and evaluation of data was not a linear process and I echo Greene’s (2000) opinion that:

> evaluation expertise today is marked by its dialectical, dialogical temperament, its openness to multiple forms and layers of understanding, and its responsiveness to contextual needs for understanding, rather than its adherence to any singular philosophy or approach. (Greene, 2000, p. 988)

In view of this non-linearity of the analysis process, which causes a degree of complexity, adhering to the validity of the participants’ input was a matter of concern to me. A factor that influences the perceived validity of research in discourse analysis is coherence in the explanation of both the broad patterns and the “micro-sequences” appearing in the data, according to Potter and Wetherell (1987, p. 170). They advise researchers to be aware of statements or situations that appear to be outside the emergent patterns, as important information often resides in these areas. Silverman (2000) reminds researchers to look beyond mere categorisation of the elements in the data, as an examination of the links between these elements could elicit “lively and original” concepts (p. 825). Boyatzis (1998), too, stresses that ‘conceptual flexibility’ is a basic ingredient for thematic analysis, but another quality he insists upon is that the researcher has the necessary knowledge of the subject area of the research (pp. 7-8).
Williams (1965, pp. 61-63) indicates that an awareness of patterns assists in the understanding of cultural relationships (see Chapter 1). Eldridge and Eldridge (1994) claim that Williams was influenced by Ruth Benedict's *Patterns of Culture* (1935), and that he means that, while the development of a theory of culture is a cross-disciplinary project, "At the same time, the approach tries not to privilege certain terms as though they were 'outside' of society, as in a phrase like 'art and society'" (Eldridge & Eldridge, 1994, p. 79). This inter-connection extends to new media.

"*Virtuality is the cultural perception that material objects are interpenetrated by information patterns*" [italics in original] (Hayles, 1999, p. 69). "Like information and noise, pattern and randomness are not opposites bifurcated into a dichotomy but interpenetrating terms joined in a dialectic" (p. 78). Her contention that "When the terms are inverted, assumptions become visible that otherwise would remain transparent" (p. 78), points to another perspective addressed in the analysis of the interview data.

Jervis (1998), too, suggests ways in which pattern can be accessed to assist interpretation. Patterns contain a framework "of experience and culture", and the "strains, tensions, and possibilities can be elicited" with the use of conceptual thought and imagination.

Indeed, the untypical, the obscure, or the extreme can be just as illuminating as the ordinary, since it is here that the latent possibilities of the everyday world become manifest, thus clarifying the 'normal'... the patterns can have contradictory implications, manifest in strains and tensions. (p. 3)

These strains and tensions can be the result of the manner in which the interview subjects constitute themselves. Foucault developed an interest in the way subjects view themselves, not only in a passive way as the result of, say, coercion, but also in an active way.

Now I am interested, in fact, in the way in which the subject constitutes himself [sic] in an active fashion, by the practices of self, these practices are nevertheless not something that the individual invents by himself. They are patterns that he finds in his culture and which are proposed, suggested and imposed on him by his culture, his society and his social group. (Foucault cited in Fornet-Betancourt, Becker, & Gomez-Muller, 1988, p. 11)
Tension is a characteristic favoured by many artists in their art work as it enables many layers of interpretation. Janesick (2000) urges researchers to "look for points of tension", or "conflicting points of evidence", within the data (p. 388). Harvey's (1990) dialectical 'deconstructive-reconstructive' analysis process draws on "elements" such as "abstraction, totality, essence, praxis, ideology, history and structure" as a way of problematising and critically reflecting on the data (p. 19).

There are many ways of working with data to identify patterns. The patterns I refer to are those defined as "an established mode of behaviour or cluster of mental attitudes, beliefs, and values held in common by the members of a group" (Gove, 1981, p. 1657). Initially, I worked through the interview data using a line-by-line keyword classification (Charmaz, 2000, p. 515). This method proved too discrete, or blunt, and did not facilitate the organisation of the data into dialectical patterns. By blunt, I mean that the possibilities became too broad and enclosed and did not provide sufficient nuances of argument for my purpose. The many days taken to code by keyword were not wasted, though, as this interaction permitted me to progress my knowledge of the data.

From the limitations experienced with the keyword coding, it was obvious to me, and taking heed of Boyatzis (1998), that, for this research, a more conceptual regime was required. I adopted a 'selective' method choosing categories from a priori experience. The categories were later expanded to include matters raised during analysis of the data. In this way, I drew on Patton's (1987, pp. 149-150) thematic content analysis that enabled a primary analytical regime which was more suited to the breakdown of the interview data. Potter and Wetherell (1987) remind researchers that discourse analysis, which, for me, is part of thematic analysis, is a developing field and that there is no set method as is usually the case with defined content analysis methods. They point out that it is now widely accepted, even in scientific fields, following the work of Kuhn and Popper, that "any observation of the physical or social world is imbued with theoretical interpretation" (Potter & Wetherell, 1987, p. 158). This thematic analysis was then coupled with pattern coding as a secondary analytical regime.

Williams (1965, p. 57) recommends pattern as valuable in analysing complex organisations and relationships. I believe my search for dialectical relationships fulfils his criteria.
A key-word, in such analysis [of culture], is pattern: it is with the discovery of patterns of a characteristic kind that any useful cultural analysis begins, and it is with the relationships between these patterns, which sometimes reveal unexpected identities and correspondences in hitherto separately considered activities, sometimes again reveal discontinuities of an unexpected kind, that general cultural analysis is concerned. (Williams, 1965, p. 63)

The identification of dialectical interactions as part of critical qualitative inquiry implies a search for patterns, as argued above and observed by Patton, and identified by Darlington and Scott (2002, pp. 142-143). In contrast, Buchloh (2000) and McGillick (2001) use the dialectic in a dialogic binary form. Kemmis and McTaggart (2000) describe a dialectical approach which facilitates the researcher's transcendence from limited thoughts of two dichotomies: "individual-social" and "objective-subjective": to a "dialectically related" view where these dichotomies are approached as "mutually constitutive aspects of one another, both of which are necessary to achieve a more comprehensive perspective on [research] practice" (p. 575). To this end, I adopted an Hegelian triadic formulation to scrutinise the data for instances of theses, antitheses and syntheses, and a post-structuralist approach to explore dialectical processes in movements in understanding, and the strains and tensions in the relationship between art and science. Bois (1997) postulates that a dualistic mode of thinking is not useful in resolving contradictions: "The dialectic, for its part, aims only to reinforce homology: homology is simultaneously its foundation, its point of departure, and its point of arrival" (p. 67).

In searching for dialectical interactions, I paid particular attention to the implications of contextual circumstances surrounding the participants and their work and looked for Greene's "multiple forms and layers of understanding" (2000, p. 988).

Data interpretation and analysis involve making sense out of what people have said, looking for patterns, putting together what is said in one place with what is said in another place, and integrating what different people have said. (Patton, 1990, p. 347)

In reporting research findings, Potter and Wetherell (1987) suggest that it is pertinent to include excerpts from the interviews as they "are not characterizations or illustrations of the data, they are examples of the data itself" (Potter & Wetherell, 1987, p. 173). The participants' comments are central to my research. They constitute an important source of data and add insightful perceptions and subjects for
discussion. Therefore, relevant excerpts from the interviews are interwoven throughout the thesis.

**Analysis of documents and other media.**

Three avenues of analysis are preferable when studying culture, according to Williams (1965), to achieve a picture of the complexities involved. The first area of concern to analyse in the definition of culture is the "ideal" and relates to the values associated with the "universal human condition"; the second is the "documentary", in which culture is the body of intellectual and imaginative work, in which, in a detailed way, human thought and experience are variously recorded"; and the third is the "social" area (p. 57). Kincheloe and McLaren assert that cultural dynamics, which would include the art practices that inform this research, influence audiences both politically and in the formulation of their identities (2000, p. 289).

Following Williams, and in order to address issues of authentic representation and legitimation, strategies other than semi-structured interviews incorporated in the research include the following: the observation of the participants and their art practices; the interpretation of art works and other material culture; the analysis of documents concerning art practices and related technologies, such as art reviews, didactic panels, artists' statements, and exhibition catalogue essays; and the review of earlier and contemporary literature, as outlined by Morse (1998, p. 63).

Hodder (2000) discusses possible approaches available to the researcher who interprets "mute evidence ... written texts and artefacts" and advises them to be aware of the "material", "social", and "ideological" conditions under which the data were produced. "In both texts and artefacts the problem is one of situating material culture within varying contexts while at the same time entering into a dialectic relationship between those contexts and the context of the analyst" (Hodder, 2000, pp. 703-705).

I take on board Hodder's views and, in view of the complexity of the issues, and the speed in which events are moving in technology, biotechnology and sci-art, some texts cited derive from non-refereed journals and other media sources not usually included in research at this level. The quotes from many of the texts retrieved from the internet do not have page numbers. Nevertheless, I have differentiated in favour of those texts that have contributed to an informed debate.
Ethical considerations

Because the research involved humans in an interview process, approval was sought from and granted by the Edith Cowan University Human Research Ethics Committee for the research to proceed. All requirements were observed.

All participants were requested to signify their consent to permit the publishing of interview data in the doctoral thesis, book chapters, and papers in refereed or non-refereed journals, understanding they would be identified. A consent clause was included at the head of the interview transcription document which was sent to the participant for approval and read as follows:

I agree that the comments in this transcription (with the exclusion of those indicated) may be published by Judith Roche and that I may be identified. (Signed) Participant (Date).

Information from the curriculum vitae provided by each interviewee was integrated into their interviewee profile (see Chapter 3). Participants were advised that the interviews would be audio recorded and that they were free to withdraw from the research at any time. Samples of documentation required for Ethics approval are attached as Appendices A and B.

All interview data was stored in a secure environment. Each participant received a transcription of their interview and, as indicated above, approval was requested to use the data and to identify the participant with any comments from the approved transcription cited in the thesis or other publications. Any comments which the participant chose to delete from the transcription were omitted from the final working copy to ensure that they were not included in the analysis process. The majority of participants did not make any deletions to their transcript, and those alterations that were made did not affect substantially the substance of the interview.

The research data is required to be stored in a confidential environment at the Edith Cowan University, Bunbury Campus, for five years after the completion of the study.
Limitations of the study

One limitation identified in the proposal for this research relates to the unavailability of participants of first choice. This limitation did not arise, as previously indicated. Nevertheless, gaining access to elite participants is frequently a problem and a possible limitation for researchers. The fact that the research was at a doctoral level certainly aided my access to the high-profile interviewees, as did the level of interest of participants in the research topic, including the development of and difficulties for biologically based art practices, and the place occupied by the traditional artist in an increasingly technologically oriented world. Another factor that may have facilitated the interview process with elite participants is that the interview questions were provided two or three days prior to the interview, thus establishing a framework to work within for both the interviewee and the interviewer.

Another anticipated limitation was the necessity, in such a rapidly changing field, to complete the investigations and to publish the data before the information is superseded. I am hopeful that events do not overtake the process in this regard, although Timms' recent publication (2004b) addresses some of the cultural and biotechnologically based art issues I raise in my thesis, and cites views which I have also referenced.

As outlined in the proposal and the introduction to this thesis, this work could only investigate the input of thirteen participants due to the time and financial constraints under which a PhD thesis is developed. I, therefore, regard this thesis as preliminary research which could provide the basis for a much wider study. Suggested areas for further research are identified in the conclusion.
Endnotes

1. For examples, such as Heisenberg’s Uncertainty principle, Schrödinger’s cat, and Wigner’s friend, see Paul Davies, (1990), *Other Worlds: Space, superspace and the quantum universe*. London: Penguin Books.


5. In his *Notes on elitism and the arts*, written in 1975, Bernard Smith (pp. 5,7) suggests elitist critics are those who “subscribe to the belief in creative genius being visited only upon an elect minority, in natural taste, and the good eye – or have written and acted as if they did” and proposes instead “a democratic theory of excellence”. Smith, B. (1988). *The death of the artist as hero: Essays in history and culture*. Melbourne, Victoria: Oxford University Press. Professor Bernard Smith (b. 1916), art historian, author, lecturer and critic, studied at the Sydney Teachers’ College, the University of Sydney, the Courtauld Institute of Art and Warburg Institute, London, and achieved a PhD from the Australian National University.

6. Two participant scientists allude to the possibility that important information resides ‘outside emergent patterns’ and that this results in opportunities for artists. Their suggestion is followed up in Chapter 11.

7. Peter Timms is an author and critic. He has had extensive experience as an exhibitions and projects co-ordinator in public museums and art galleries in Australia. In the 1980s, he received a Winston Churchill Memorial Fellowship to study in Europe.
CHAPTER 2

LITERATURE REVIEW

Every epoch not only dreams the next, but while dreaming impels it towards wakefulness. Walter Benjamin

Introduction

This literature review seeks to locate the role of the artist in the cultural and social environment at the beginning of the twenty-first century, and to ascertain any dialectical impacts on that role from developments in science and technology. The interview questions were formulated after collating this information and assessing which areas of the body of knowledge would provide fruitful streams of research.

The themes addressed in this literature review are derived from the thesis topic. They include art and the artist (traditional and new practices with a connection to science and technology); creativity and conceptual thought including problem seeking and problem solving skills (in relation to art or science); the dialectic (history, current usage, and relevance to this research); and science and the scientist (in interaction with art and technology). For ease of reference, the areas mentioned are addressed in sections, but, as is appropriate in an interdisciplinary research enquiry, each section is not a discrete entity and the boundaries are permeable. For example, in the section Dialectic, references are made to views on art, and the role of the artist, which would be equally appropriate under Art. Jones (2002) highlights this cross-disciplinary and cross-subject dilemma: "what is art doing in the biology lab, the genetics lab? Bio-technology is the future and artists want a say in it. This is art as philosophy, as investigation, not as decoration."
Art and the artist

This section of the literature review reflects on earlier and contemporary views on the nature of art and the artist’s place in society. It also introduces the ways in which proponents of various new media art practices locate their work, and that of more traditional artists, within the prevailing culture. These and other topics canvassed, including the avant-garde, communication, and technology, provide a background for assessing the role of art and the artist at the start of the new millennium.

Various references date from the mid-twentieth century when many texts, such as C P Snow’s seminal essay and lecture in 1956 and 1959 respectively, discussed the functions of art, science, and culture in society. Nevertheless, a focus has been maintained on the late twentieth and the early twenty-first centuries and the need to establish appropriate interview questions.

Background to the role of art and the artist

In 1959, Ernst Fischer supported a role for the artist in a return to humanism in art and a liberalisation of Marxist concepts such as realism. He declared “Art is necessary in order that man [sic] should be able to recognize and change the world. But art is also necessary by virtue of the magic inherent in it” (cited in M. Solomon, 1973, p. 270). In a similar vein, Bukharin (1973) observes: “it [the nature of art] is a systematization of feelings in forms; the direct function of art in socializing, transferring, disseminating these feelings, in society, is now also clear” (p. 205).

Bentall (1972) notes how art work that dealt with the overall, comprehensive human experience, as opposed to the fragmented and specialised view, was discouraged in the mid-twentieth century by many galleries and other art establishments. Bentall confronts the problem of the role of the artist but he finds a formula elusive. He suggests the term ‘artist’ “combines the sense of ‘visionary/philosopher/prophet’ with the sense of ‘craftsman/technician/designer’” (1972, p. 12). However, Bentall observes that the changes occurring mid-twentieth century included “attempts ... to redefine art as a mode of enquiry much closer to science” (p. 151). He hypothesises that: “If art is thought of as primarily a process of enquiry rather than a process of production, we must consider the true meaning of the term ‘experiment’ in art” (1972, p. 153).
Benthall’s idea of experiment has been adopted by artists, and this, in conjunction with their engagement with art and science, has led to various roles; for example, illustrator, critic, recipient and utiliser, interrogator, and, to a lesser degree, participant as researcher. Artists’ innovative practices in the many forms of technologically based new media run parallel with the postmodernist trend of interdisciplinary exchange.

Dufrenne (1980) debates the advantages and disadvantages for art in its relationship with technology. One aspect he raises, (as do some of the research participants in Chapter 7), is that much of the new technology is within the control of those whose aims are “power and profit” and suggests that artists need to be aware of this situation (p. 168). (Rutsky’s (1999) views on art, technology, and techne appear in Chapter 10). Dufrenne states that:

Art cannot so easily forge the primitive techne. For art is above all doing, a setting up as Souriau would say, or poiesis, as Valery would put it. Doing in the sense of perfecting, with pleasure, with taste. A loving battle with a resisting material, friendship with the tool that extends the body, a flirtation with the obstacle, a game of chance in which one never establishes enough control to eliminate all surprise. (1980, p. 167)

If art “is above all doing”, changes in approaches to art practices that have prompted new art movements have been marked by the publishing of manifestos; for example, movements known as Surrealism and Suprematism et cetera. Other artists have developed their own approach to their practice in response to changes in the world around them.

Artists who contribute to major revisions in modes of representation must resist the societal pressures to maintain stability and must find support for their creative endeavours both within themselves and in segments of the society. (Blatt & Blatt, 1984, p. 55)

Blatt and Blatt also note a correlation between scientific and artistic developments, and a move away from the perceptual to the conceptual. Genocchio (2002) observes that Peter Kennedy was among Australia’s early conceptualists who examined “the role and function of art in society in order to make it more relevant” (p. R21). Kennedy was a founding member of one of Australia’s earliest artist-run avant-garde spaces. Genocchio reports a similar sentiment in his review of artist
Simeon Nelson: "Nelson's works consider the impact and obligations of everyday existence, grounded in the idea of collective responsibility and ethics based on principles of trust, co-operation and respect" (Gnocchio, 2000, p. 8). Nelson is Senior Lecturer in Spatial Design at the University of Hertfordshire, and his exhibition, Passages, was shown in Australia in 2000. Public projects, installation, sculpture and digital work all form part of his wider art practice, in which Nelson addresses issues arising from the interface between humans and nature.

While Mathew Collings, the British painter, writer and television art presenter, agrees that some seriousness is essential to worthwhile art, he has a low opinion of recent endeavours. In an interview with Herd (2002) Collings said: "I think painting is an art [form] where seriousness and playfulness are in equal balance. It's quite clear the best stuff was done in the 17th century and ended in 1950, and now it's bullshit" (Herd, 2002, p. R15). His comments in respect of the seventeenth century are in accord with the thoughts of Arnheim (2000), who, in his discussion of Leonardo's The Last Supper, 1498, stresses the importance of "lasting, stable images" that constitute "a store of lasting meaning".

The awareness and understanding of our experience depends on the interaction of stable, lasting images and the coming and going of happenings in time. The stationary images allow us to explore the world in its being, while the transitory ones let us follow what takes place in sequence. (Arnheim, 2000, p. 168)

Within this context of rapid change, traditional artists face another conundrum: although several traditional artists with whom I have spoken vow that their work takes on a life of its own during the artistic process, the life of their lasting images continues after the death of the artist. How does this element affect the role of the artist? Most informed critics review art with cultural and theoretical contexts in mind, but a divergence from the original meaning intended by the artist can occur through various possible circumstances: these include the influence of the critic's personal ideas and interpretation; the critic's lack of research; a change of physical environment in which the work is viewed; a change in theoretical framework in which the work is reviewed; and the passing of time. As Allen (1997) reasons, "we have to be wary of taking contemporary accounts of pictures at face value - the best art says things that cannot yet be put into words" (p. 12).
Wolff (1993) is cognisant of the influence of theoretical frameworks and claims that "as theory continues to de-centre the subject and displace the artist as creator, popular cultural texts have accelerated the opposite tendency" (p. 146). She invokes as examples the proliferation of "biopics" about the lives of artists, writers, composers and pop stars to support her claim.

Nevertheless, new technologies have complicated aspects such as the artist as creator, and copyright, particularly in respect to the "collective production of art" (Wolff, 1993, p. 147). Wolff cites David Hockney’s use of the fax machine, and Sherrie Levine’s use of appropriation, as examples to support her claim that the use of technology by artists negates notions of "pure creativity on the part of the artists themselves".

Inasmuch as the new technologies have been taken up by artists in various media, they have only served to make more visible the myth of total originality which still characterises our notion of art. (Wolff, 1993, p. 147)

Regarding issues of authenticity and creativity, Wolff again states her belief in a role for the author/artist.

The multiple sources of displacement of the author from the text (collective production, textual meanings, readers’ licence, and the de-centring of the author as possible unitary source of meaning) does not entail the evaporation of the producing subject, or the irrelevance of biographical information. As I have suggested, we have to reconceptualise the producer as (non-unitary, provisionally fixed, psychically and socially produced) originator of the text. (1993, pp. 152-153)

The Chapman brothers produce precocious, risk-taking exhibitions that range from female mannequins with noses shaped as penises, to 80 defaced mint edition Goya prints from the Disasters of War series. Their installations comment on religion, and international trade and politics, and the artists claim that art is a definitive item in a capitalist economy as “its value is impossible to measure against any conventional scale” and its worth in monetary terms is calculated by the market (cited in Field, 2003, p. 45). Writing earlier, Berger (1972) agrees that the art market determines the value of the art object, but he adds “because it is nevertheless ‘a work of art’ – and art is thought to be greater than commerce – its market price is said to
be a reflection of its spiritual value.” He suggests that this “spiritual value” derives from the “holy relics” approach to paintings (p. 21). Another pertinent Chapman observation is that, although a purchaser may own an art work, that person does not own the art work’s “meanings” (Field, 2003, p. 45). Berger (1972), too, notes that oil paintings often “depict things” and that, “If you buy a painting you buy also the look of the thing it represents. This analogy between possessing and the way of seeing which is incorporated in oil painting, is a factor usually ignored by art experts and historians” (p. 83).

An inquirer into arts based or visual culture is destined to encounter the term ‘avant-garde’. By the 1920s, ambitious artists needed to commit themselves to the “quirky god Avant-Garde”, according to a tongue-in-cheek Wolfe (1976, p. 17). Huyssen (1980) sees a role for the avant-garde to address “those human experiences which either have not yet been subsumed under capital, or which are stimulated but not fulfilled by it” (p. 164). Marcuse equates avant-garde art that challenges and contradicts the status quo with the dialectic: “Art denies a mutilated civilization, it ‘recovers tabooed meanings’ and permits the repressed archetypes to re-emerge as liberating forces” (cited in M. Solomon, 1973, p. 523). However, if, as Berger (1972, p. 10) suggests, “images were first made to conjure up the appearances of something that was absent”, biologically based, new media, and traditional art practices at the beginning of the twenty-first century continue this role, as is demonstrated in later chapters of this thesis.

Visual culture theory

Research that interrogates the nature of art and the role of the artist in professional art practices includes subjects within the emerging field of visual culture theory. Such theorists are among others who suggest that, in a world inundated with visual imagery, through avenues including television, advertising, magazines, videos, and the internet, images are taking over the role of written text in the dissemination of information. Fuery (2000) postulates that the analysis of images as part of a study in visual cultures is a different intellectual activity than, for example, the analysis of such images as part of film studies, and that the development of “analytic competence to address an increasingly image-driven world” is the agenda of visual culture theorists (p. 39). Fuery cites Foucault, Barthes, and Derrida as theorists who engage with the visual. Observations by these post-structuralists are included in this
literature review but this field is also being addressed by academics in education who are developing an arts based qualitative methodology paradigm and recognise the significance of interpreting artefacts as well as written texts (see Chapter 1).

Eagleton (1998) elaborates on culture and its function in the time of John Ruskin, William Morris, and D H Lawrence, as the link between art, industry, class and politics, and he imbues art with the power to communicate change to the community. Eagleton’s notion of using art as a communication tool is one I found prevalent among the scientific community during the interviews, and it is discussed throughout the thesis chapters. This interaction between art and society in the late nineteenth century Eagleton denotes as dialectical, and, in this tradition, “the three major meanings of culture – as art, as lived experience, as social structure – are linked and interwoven into a new social critique.” However, Eagleton is aware of the cracks that are beginning to appear: “the opening of what felt like an unbridgeable rift between two meanings of ‘culture’: culture as the direct, dialectical embodiment of ideal human value, and culture as the negotiation of this value into social reality” (1998, p. 106).

Snow’s ‘two cultures’, from his essay for the New Statesman in 1956, and his Rede Lecture, Cambridge, 1959, are defined as science and literature (Snow, 1993). Sontag (1967) does not support the concept of a conflict, in the 1960s, between Snow’s ‘two cultures’, but suggests “we are witnessing ... the creation of a new (potentially unitary) kind of sensibility.... Art today is a new kind of instrument, an instrument for modifying consciousness and organizing new modes of sensibility” (p. 296). Beathall (1972) also anticipates change. “Great hopes have been expressed about the reuniting of art with science and technology” (p. 11).

Wilson (1993) examines the relevance of cultural theory to the contemporary art practitioner in a period of accelerating technological change. He discusses modernist and postmodernist discourses, and proposes three ways in which artists can proceed in a technological world: to “seek in a modernist sense to assimilate technological art to the mainstream art world as it was historically constituted”; to adopt “a deconstructionist practice which uses the skills, tools and familiarity with the technology [sic] world to critically analyse the meta-narratives of contemporary life”; and “to enter into the heart of the inventive process to help elaborate the culture transforming possibilities of new technologies”. Wilson appears to overlook the
validity of a fourth modus operandi – that of the artist who engages closely with researchers, innovators of technology, and theoreticians to establish a constructive overview, but who uses traditional media to reflect, in an informed manner, a response to the possibilities, both recognised and envisioned, positive and negative, raised through the new developments. In other words, most traditional artists resist categorisation and could work seamlessly over all three of Wilson’s proposed practices.

The fourth mode of practice suggested above is relevant given the ethical, cultural and economic implications raised by the new developments in science and technology. Wilson (1993) concedes that advances in technology are outstripping “culture’s ability to make sense of it”. Indeed, Wilson concludes that, although theory offers powerful concepts and methodologies which are “useful for understanding what exists, they are problematic for envisioning what might be”. I argue that his statements add weight to the call for discussion to facilitate meaning-making of the new developments from all perspectives, and, thus, to the potential significance of my study.

The concept of meaning has been central to postmodernist debates. “Implosion of meaning” is a concept which Wilson (1993) raises several times, and Baudrillard’s (1993) “hyper-reality” describes the condition where people begin to confuse the “electronic reality” with the actuality of life: “From medium to medium, the real is volatilized, becoming an allegory of death” (p. 1049). He elaborates on this concept in another text in which he extends McLuhan’s notion — that the medium by which the information is disseminated becomes the event itself — to embrace a total implosion of meaning.

There are no more media, in the literal sense of the term (I am referring particularly to the electronic mass media), that is to say, in the sense of mediating between one state of reality and another, and that is true for both form and content. That, strictly speaking, is what implosion means: the defusing of polarities, the short-circuiting of the poles of every differential system of meaning, the obliteration of distinctions and oppositions between terms, including the distinction between the medium and the real. Hence any mediation or dialectical intervention between the two, or by one on the other, becomes impossible. ... it is futile to dream of a revolution through either form or content, since both the medium and the real now form a single inscrutable nebul. (Baudrillard, 1980, p. 142)
Rather than an implosion, Huyssen (1980) pronounces the influence of technology on art and mass culture as dialectic. His analysis suggests that, in the twentieth century, the cultural industry played a greater part in transforming the day-to-day existence of the populace than the avant-garde, although, as mentioned previously, he still locates a role for the avant-garde. Huyssen also states that the aesthetic experience "is uniquely apt to organize fantasy, emotions, and sensuality against the repressive desublimation which is so characteristic of capitalist culture since the 1960s" (p. 164). His opinions, expressed two decades ago, are pertinent to considerations of the role of the artist in the twenty-first century.

New media art forms including biotechnologically based

Biologically based artists have introduced another form of art practice and address issues of interdisciplinary collaboration. "The artists in BIOFEEL argue that the issues exposed by genetic manipulation and animal experimentation for commercial and medical purposes are matters that should not be left solely to scientists and entrepreneurs" (Jones, 2002). The BIOFEEL exhibition brought international bio-art to Perth, Western Australia, as part of the BEAP programme in 2002. This is discussed more fully in Chapters 3 and 5.

Jones (1997) claims that "interactions between art, science and technology are leading to the emergence of new cultural forms, behaviours and values." He appropriates the term "technoetic" from Ascott (see Appendix C) and links it with the "use of technology in cultural production, and it also refers to the noetic, or how we understand the world and our processes of being in it" (Jones, 1997).

Jones (1997) also notes: "A primary issue confronting new-media artists is the politico-economic question of the human and environmental impact of their work." He hypothesises that new-media artists who critique notions of "humanizing technology" are faced, not only with choices that involve "a subversive generativity of ideas and of methods for handling technological presence", but also with the prospect that their ideas and resulting work will be appropriated as profit-making opportunities by business. Ackroyd's and Harvey's use of hyperspectral imaging to develop a new form of grass demonstrates this point (see Chapter 7). However, he sees a refusal to participate in the debate as a step towards irrelevance, as there is
nothing to be gained from withdrawing from the system. His point is not lost on several of the research participants (see Chapter 8).

Practitioners in the biologically based field frequently quote Wilson (2002) who recognises the limitations to research in the new media area.

There is not yet a robust canon for interpreting the art described in this book. Its rapid development, integration of disciplines outside of art, and movement into new technologies and contexts all make it more difficult to assess its significance than with more conventional art forms. (p. 88)

The role of the artist as scientific researcher gradually declined following the extensive activity experienced during the Renaissance. However, during the twentieth century, interest was renewed, in part due to the growing awareness of the exciting scientific and technological developments taking place (see Chapter 11).

Whitelaw (2000), too, assesses the status of the electronic arts at a time when technology has been absorbed into daily life and when the future is “arriving”. He claims that new media artists have benefited from following the “technology juggernaut” and appropriating developments into their art practices.

Sparked perhaps by the reluctance of the established art-world to accept their work, artists using electronic media have gathered, over the past two decades, under such generic banners as “electronic art,” “digital art,” and “new media art.” An active international scene has emerged, with its own institutions, events, stars, critics, and gossip, all organised around a common creative engagement with technology. This identification with a technological medium has been useful in many ways: technology is a drawcard, a (largely) positive cultural marker, often attractive to the powers that be. While often highly critical of its technologies of choice, electronic art has also been happy to borrow the progressive rhetorics of “cutting edge” technoculture for self-promotional purposes. (Whitelaw, 2000, p. 2)

Whitelaw points out that, in the twenty-first century, new media are “not-so-new”, and he asks, where do these artists head now? “Those with a hankering for the experimental fringes will no doubt continue to seek out esoteric and emerging technologies; biotech art is already a reality, no doubt nanotech art is close at hand” (2000, p. 2).

His comment is prescient. Vesna and Gimzewski (2002) promote the notion of nanotechnology as a field for art and science collaboration. They describe their
work \textit{Zero@wavefunction} as "a set of wavefunctions of human existence and of technology and science woven together in a dynamically transforming landscape with probabilities of being and NonBeing of time and Notime".9

According to Whitelaw (2000), there is another alternative. New media artists could cease the use of the 'new media' banner, a point also raised by a participant in this study (see Chapter 4). It is Whitelaw's opinion that this could be a useful step in that it would concentrate attention on the content of their work rather than the category in which they operate (see Chapter 11). "More space and energy will be left for a real engagement with the work, in all its cultural and creative specificity ... These banners involve an act of differentiation, a declaration of a separate practice – yet among the richest zones are those where electronic media meet existing creative and discursive traditions" (Whitelaw, 2000, p. 2). However, the question of funding arises.

What about those organisations structured around medium-specific banners? What of the funding bodies, who play an important role in the construction of those categories of practice? Without the banners of "new media" or "digital art," and the sense of solidarity and legitimacy which they bring with them, artists may find it even more difficult to gain support for their work. (Whitelaw, 2000, p. 3)

Vesna (2001) argues that artists "utilizing new technologies" are critical to the exercise to build a bridge between the humanities and the sciences. Although she contends that these artists are developing "an atmosphere of collaboration and mutual respect", Vesna warns that there are dangers. The greatest danger arises when artists adopt interpretations of scientific data from "literary, philosophical and theoretical circles" and then "further reinterpret these versions without checking back with the scientists" (2001, p. 122), (see Chapter 5). Another danger arises from the general attitude holding theory above practice, prevalent in both the humanities and sciences. At this stage, it is in the practice of art that the freedom lies to make assertions beyond the rational and beyond the necessary methodology of proving a thesis. Practice informed by theory – or, conversely, theory informed by practice – utilizing a methodology accessible to both worlds is the key. (Vesna, 2001, p. 122)

Vesna proposes several reasons why most of this interaction between practice and theory takes place in universities. Firstly, she claims there is a limited market in
place for artists working in this area and they are unable to earn an income outside academia and industry – and an involvement with industry brings pressures to produce. Also, academia provides “access to good bandwidth and updated equipment”, and “allows artists contact with scholars from many disciplines” (2001).

In order to function and communicate effectively in this context, one must learn the etiquette and language of various disciplines. The challenge, then, is to do this without losing the intuitive, “wild” aspect of artistic practice, which taps into the silent, the unknown, and the mysterious. (Vesna, 2001)

If, as Vesna contends, the artist is cast in this demanding interdisciplinary role, the question arises as to how current university curricula can facilitate a broader education of art students that provides them with the necessary knowledge and skills (see Chapter 4). As well, her acknowledgement of the limited resources available for techno-artists raises the prospect of an elitist group culture.

In Art as Research, Wilson (1996) again details three paths artists could tread in response “to the growing importance of scientific and technological research in shaping culture”. They could act “as consumers of the new tools”, as commentators “on the developments from the distance”, or “as core participants”. Once more the commentary option is seen as a “distanced” function but, in practice, it is frowned upon by many artists because it implies they are merely illustrators (see Chapter 6). Nevertheless, Wilson believes there is a positive part for the artist in the unfolding scenario of the “shaping of research and development agendas” (1996). He identifies some of the advantages of artistic traditions enjoyed by artists: for example, the use of iconoclasm; the valuing of social commentary; the consideration of criteria such as celebration, play and wonder; the interest in communication; and the valuing of creativity and innovation. Although Wilson acknowledges some of the assets of traditional art practices, he does not appear to anticipate a major role for traditional artists in engagement with the technologically based field.

Burnham (1980) is scathing in his assessment of the efforts of visual artists to incorporate technological developments, such as electronic and electrical advances, in “socially acceptable art” and dismisses the majority of their attempts as “dismal” failures (pp. 200-201). In comparison, he deems “successful” some art works, such
as those of Jean Tinguely, that “deal with the absurdity and fallibility of the machine”.

During the 1960s, exhibitions of collaborative works between artists and engineers, (although reasonably funded), received mixed reviews. According to Burnham (1980), artists and critics expressed apprehension at the prospect of the demise of traditional art media and the takeover of the art world by “engineer-controlled art” (p. 207).

Burnham was one of the first fellows at the Center for Advanced Visual Studies, Massachusetts Institute of Technology, which opened in 1968. He traces the activities of the Center and suggests that “the rapid decline of technological art as one of the pet ideals of the avant garde” was one of two causal factors for the reduced financial support for the Center from the mid-1970s (1980, p. 208). The controversy surrounding the Art & Technology exhibition of 1971, the suspicion of “a nefarious connection between advanced technology and the architects of late capitalism” (p. 210), and the disparaging press reviews, would not have helped. According to Burnham, captains of industry, on the other hand, are aware of the limited research capabilities of the majority of artists and would not be so naive as to consider art as an efficient strategy for marketing “Technocracy as a successor to Capitalism” (p. 211).

Despite his criticism that art of the 1960s and 1970s was reluctant to be self-critical while remaining “implicitly critical of everything around itself”, Burnham proposes that art

> encompasses all aspects of the psyche equally; mythic fantasy, technological skill, esthetic idealism, manual craftsmanship, a variety of contents, but most importantly an internal semiotic consistency which prevents it from becoming absorbed by other disciplines, no matter how powerful or persuasive. (1980, p. 212)

Burnham’s reasoning that art resists absorption by other disciplines may have been applicable in the 1970s, but, in 2004, the proliferation of new media based work, typified by Documenta 11, 2002, and the Venice Biennale, 2003, and the work of artists participating in this research, would raise questions about the basis for such an assertion today.
Planetary Collegium Founding Director, and former CAiiA Director, Ascott, a strong proponent of international new media exhibitions, makes expansive claims for technoart. His stance reflects his position among his peers who regard him as one of the prime instigators of an international new media art culture. Ascott conveys the notion that the interface between art and technology works on spiritual, biological, and social levels. "In this reconfiguration of ourselves and our culture, the process of transformation lies between what I call cybereception, technologically extended cognition and perception, and the technoetic aesthetic, art allied to the technology of consciousness" (Ascott, 1997). He further claims that

we are engaged in a new social process. This in turn flows from the new thinking that circulates in, around, and as a consequence of the convergence of computers, communications, and biotechnologies, which is leading to the reinvention of the self, the transformation of the body, and the noetic extension of mind. In the process, art has shifted its concern from the behaviour of forms to forms of behaviour. (Ascott, 1997)

Ascott notes that ‘noetic’ is developed from the Greek ‘nous’, meaning mind. Technoart also embraces the field of artificial intelligence (AI) and its proponents suggest that artificial consciousness will be part of AI. Ascott claims consciousness equates with a living being having the "power of choice", and, from this, he deduces that "in short, it [consciousness] is the space of art" (1997). Nevertheless, Ascott acknowledges that artists no longer have total control of the work in the technoetic sphere. Appendix C contains a glossary of new media terms coined by Ascott.

Interactive technoart requires the participation of the viewer. This participation brings new experiences to the work that the artist may not anticipate, and through which the work may evolve in a different direction. In this connection, Ascott (1997) concludes that technology is seduced by art. It is difficult to reconcile his argument that the artist no longer has total control with his argument that art has seduced technology. Could this be a reflection of a technological culture that regards the artist as a mere cog in the manufacture of the art which then becomes the principal subject, the prime concern? As technoart requires a team effort between the artist and the technician, such as in the work of Patricia Piccinini, the notion of the possible 'death of the artist' comes to mind. This has not proved to be the case for Piccinini and other new media artists who employ teams of experts to realise their
projects. In many of these instances, the originating artist is accorded a high profile and others associated with the work are acknowledged but not celebrated. The employment of assistants to realise art work has long been the case, as demonstrated by artists such as Rembrandt, Leonardo da Vinci, Warhol, and others. Smith (1988), the seminal Australian art historian, addresses issues relating to the death of the artist as here, and Barthes, too, argues for the idea of the death of the author, and art's loss of aura (see Chapter 4.) On the contrary, Taylor holds that:

Writers like Louis Althusser, who thought that individuals were mere "effects" of ideology and that human agency was an illusion; or Jacques Lacan, who thought that feelings and desires were somehow the "results" of patterns of language; or Roland Barthes, who argued for the "death" of the artist as an expressive and creative being; these writers have little place in my analysis except where they can be used to show the truth or credibility of a contrary position. (Taylor, 1987, p. 14)

As exemplified by Piccinini, contemporary technology-based celebrity artists maintain their aura and it is usually the artist's name, rather than that of the technical support team, that features in catalogues, essays, and other documentation. Ascott writes:

The viewer is complicit in this ["evolutionary process"], interactively adding to the prepositional force that the artwork carried. It is seduction in semantic space: Barthe's [sic] jouissance [sic] all over again. And it is a poetic enticement, an invitation to share in the consciousness of a new millennium, the triumphant seduction of technology by art, not the seduction of the artist by technology. (1997)

Inversely, Olson (2000) details the research required for him to establish who drew the first picture of DNA [deoxyribonucleic acid], the double helix, as the artist is not acknowledged in Crick and Watson's paper, nor in Watson's memoir, The Double Helix. Olson approached Watson, who advised him that Elizabeth Kendrew, Watson's tennis partner, drew the artistic interpretation. Olson's research is discussed in more detail in Chapter 6.

Creativity and conceptual thought

At the beginning of a new millennium, the arts are well placed to participate in an interdisciplinary conversation. Nobel Laureate, Professor Peter Doherty (cited
in Beckmann, 1996), champions the cause for an education system that places more emphasis on "basic science": "that is, research aimed at understanding mechanisms rather than developing technological applications". Doherty agrees that scientific methodology checks hypotheses to try to falsify them. However, he emphasises the need for an open mind, and that the scientist needs to "be prepared to drop one line of inquiry and follow another if it looks interesting". In particular, he states that "conceptually-driven research, as opposed to end-use driven research, is what is likely to yield some of the biggest benefits" and mentions that "a certain amount of serendipity" was involved in the research process that resulted eventually in a Nobel Prize (Doherty cited in Beckmann, 1996). Doherty's comments point to the notions of several participants in regard to the exploration of 'discards', an issue that surfaces throughout the thesis.

Arnheim (1969) provides a clear picture of the role of the artist in relation to science in the 1960s, and the need for the education of the artist. He recognises that the art studio is the ideal situation in which to train students in perceptual thinking, and contends that scientists benefit from the conceptual expertise of artists in "visual pattern"; for example, in the preparation of models. "He [sic, the artist] is accustomed to visualizing complexity and to conceiving of phenomena and problems in visual terms" (Arnheim, 1969, p. 296). Here again is a link with the idea of the exploration of 'discards'.

Vesna (2001) asserts that "both artist and scientist are involved in the work of intuiting change in perception and materializing it for others to experience, see and ultimately change". In a similar vein, Blatt and Blatt (1984, p. 349) advocate that "Art and science are both expressions of a general cognitive mode that pervades the culture and is expressed in all its intellectual endeavours", a view supported by Medawar (1979, p. 39). Later, Blatt and Blatt add literature and philosophy to this cognitive structure (1984, p. 363).

Ragsdell (1996) discusses the relevance of creative thinking to organisations today and the difficulty theorists have in agreeing upon an appropriate definition for creativity. For Ragsdell, "creativity is a quality that defines the arts. This is rarely the case in the sciences, in particular the sciences of management where my interests lie" (1996, p. 141). Her acknowledgement that creativity is intangible leads her to an extensive review of texts on creativity by numerous authors and a discussion of
techniques such as brainstorming and role playing. Ragsdell resolves the dilemma by turning to critical creativity which she presents as a system that allows creativity to be integrated with problem-solving approaches. Although her treatise offers assistance for organisations and addresses questions of the genius, and the traits assumed to be exhibited by creative people, the issue of a definition of creativity is not resolved for the artist.

Printmaker and lecturer Constance Jacobson's art has related to biology for many years. Her recent exhibition *Almost Biology* "refers to fabricated scientific imagery and an imagined parallel universe." She observes:

> While viewing these images after completing them, I was struck by the essential difference in perception between the scientist and the artist: When looking through a microscope at a dissection or an x-ray, a scientist asks, "What is the content of what I am seeing, and what are the implications?" while the artist asks, "How does this appear, and how can I transform this into an aesthetic, personal, or historical/cultural statement?" The phenomenology of viewing is paramount for the artist, and veracity means only that the subject matter be visually believable within the imaginary world the artist has established for the viewer. (cited in Tarlow, 2003, p. 22)

In the Afterword to the second edition of *The Social Production of Art*, Wolff (1993) observes the changes which have taken place in academic circles since the first edition (1981) was written. Wolff relates that, in the late 1970s in Britain, cultural studies, media studies, and the sociology of the arts were growth areas, including the "development of a social-historical-critical perspective in the humanities, especially literary studies and art history" (1993, p. 144). However, she asserts that government policies of reconstruction in higher education in Britain "affected the project of an inter-disciplinary sociology of art" and prompted the migration of many academics and scholars to the USA, Canada, and elsewhere.

One of the results of the transformation of tertiary education has been a kind of cost-consciousness which has pushed research and teaching into the direction of more 'useful' work – projects which attract funding, or which can be seen to have more immediate relevance for social problems. (Wolff, 1993, p. 144)

The issue of the education of artists, and the benefits that accrue to the wider community, is discussed in Chapter 4. Hofstadter (1985) suggests that creativity
develops not only in the artistic field but in life generally as individuals seek to move out of the routine of ordered daily life and to determine

the form and content of their life, [to] experience the rebellion of life within their own selves, and they find themselves in profound alienation from much of the traditional culture. So they are in the midst of the crisis that is characteristic of creativity generally: the crisis of estrangement, alienation, otherness, difference. (Hofstadter, 1985, p. 203)

The primary issue in Briskman’s (1985) paper is the notion “that creativity is something we value, and that the notion of creativity is an evaluative one” (p. 129). He notes that if the mystery were removed from creativity, creativity itself could cease to exist. Therefore, Briskman suggests that “we want a theory according to which creative scientific and artistic achievements have the right to exist, not one according to which they are under an obligation to exist” (1985, p. 132). He asserts that the creative product is central to the argument as it is the evaluation of the product that determines whether or not it (or its maker) is creative. He sees creative products as transcendent — they transcend what has gone before, “the tradition out of which they spring”, as does the creative scientist and artist. Several participants relate similar experiences to that described by Briskman.

The creative artist or scientist does not simply produce a transcendent product; in a certain sense, he (sic) actually transcends himself. He produces something which he could not have willed, and which he could not know he had the ability to produce.... One is reminded of the beautiful story about Haydn who, listening for the first time to his Creation, broke into tears and said: “I have not written this.” (Briskman, 1985, p. 150)

The Dialectic

The dialectic as an analytical tool is discussed in Chapter 1, and the theories and philosophies pertaining to the dialectic are discussed in this Literature Review.

A defence of Hegel’s dialectics against neo-Kantian texts was published by Labriola in 1862. “By dialectics we mean the rhythmic movement of understanding which tries to reproduce the general outline of reality in the making” (cited in M. Solomon, 1973, p. 91). Theorists and philosophers have discussed the properties attributable to the dialectic for several centuries examining discourse, binary, and
triadic interpretations. Critical theorists adopt the dialectic as a tool to scrutinise social and cultural mores (see Chapter 1). In view of its history and continued use, the dialectic is an appropriate theoretical basis for research into the role of the artist, particularly in relation to the social and cultural dynamics that pertain to technologically and biologically based art practices.

Raymond Williams (1983) defines the dialectic in philosophical terms and considers its history has been influenced by Plato's two streams: one of "the art of defining ideas" (logic), and the other "the method of determining the interrelation of ideas in the light of a single principle" (metaphysics) (p. 106). However, I argue that there is a conceptual connection between Labriola's thoughts on dialectics and Williams' thoughts on pattern (see Pattern, below.)

The connection between dialectics and pattern suggests to me the use of the triadic form of the dialectic usually ascribed to Hegel. However, Williams (1983, p. 107) and Walter Kaufmann (1960, p. 127) question the attribution to Hegel of the triadic dialectic structure of thesis, antithesis, and synthesis. Kaufmann supports Williams in that he asserts that Fichte and Schelling spoke of theses, antitheses, and syntheses, and Hegel did not. In his opinion "neither his [Hegel's] analyses in the Logic nor his dialectic in general can be reduced to any such three-step". It is Kaufmann's opinion that discrepancies arose in some translations from German into English and that "antithesis" appears "to render words that literally mean 'other' or 'opposite'; and secondary sources perpetuate the legend that Hegel construed everything mechanically in terms of three concepts which he actually spurned" (Kaufmann, 1960, pp. 127-128). Hall differs.

Hall (1989) agrees with those who claim Hegel "gave a new turn to dialectic", a process Hegel regarded as "consisting of a necessary movement from thesis to antithesis, and then to a synthesis of the two" (p. 81). Magee (1998), who ascribes the three stage dialectic to Hegel, observes that, because the synthesis is a new situation, it contains new conflicts, and, therefore, instigates a new triad of thesis, antithesis, and synthesis.

This, says Hegel, is why nothing ever stays the same. It is why everything — ideas, religion, the arts, the sciences, the economy, institutions, society itself — is always changing, and why in each case the pattern of change is dialectical. (After Hegel's time the dialectic came often to be referred to as "the law of change"). (1998, p. 159)
However, Kaminsky (1962), who favours Hegel's hypothesis, juxtaposes Hegel’s views on the dialectic with Being and Nothing. Kaminsky notes that Hegel introduces a third concept, Becoming, which “signifies an experience that is and yet is not... Becoming, in the language of the Hegelian dialectician, produces a synthesis out of the thesis, Being, and the antithesis, Nothing” (p. 15). According to Kaminsky, Hegel considers art as “a highly important instrument for giving us insight into the nature of the Idea” (1962, p. 27). The notion of a new kind of reflection is the way Eagleton (2000) describes dialectical thought; one that develops when a society seems self-contradictory in its processes of privileging some “human potentials” while suppressing others (p. 23). In view of the nature of the art work discussed in this thesis, and the notion of privileging some art practices over others, it is appropriate to question the extent to which a synthesis (or new understanding) is created by the interaction between art, science, and technology.

Scientists adopt a process of test and criticism similar to the trial and error method that is essentially one of elimination. Although Popper (1972) acknowledges that others say that thought develops on Hegel’s dialectic lines, he explains that, in Plato’s time, dialectic had several meanings, one being “[the art of] the argumentative usage of language”. He asserts that another of those meanings was similar to his own “scientific method” of falsification. However, like Kaufmann, Popper questions interpretations of Hegel’s terminology.

In Hegel’s terminology, both the thesis and the antithesis are, by the synthesis, (1) reduced to components (of the synthesis) and they are thereby (2) cancelled (or negated, or annulled, or set aside, or put away) and, at the same time, (3) preserved (or stored, or saved, or put away) and (4) elevated (or lifted to a higher level). (1972, p. 314)

Popper concedes that the dialectic triad does describe “certain developments of ideas and theories, and of social movements which are based on ideas or theories”, but he explains that, although the “dialectic development” may appear to conform to his trial and error method, it is not exactly the same (1972, p. 314). Although he agrees that usually human thought develops from a single idea, in Popper’s trial and error method more than one thesis can be offered to start the debate, these theses can be independent of one another, and not necessarily opposed to the other. I agree with Popper that the dialectic is not a trial and error mechanism, and I perceive the dialectic, not in a modernist binary categorisation, but as a philosophical construct.
that can incorporate a range of ideas, not necessarily opposed. The important point is that this process leads to the productive, critical exercise of debate and discourse.

As Docker (1994) sees it, the 1980s disturbed the modernist binary oppositions, and the dialectic, which "assumes history as meta-narrative, as governed by logic and laws", is required to compete with the dialogic, which "refers to forces and meanings which endlessly shift and slip". His interpretation is of relevance to me as — although I invoke logic to address what I consider to be dialectical relationships between art, science and technology — sometimes components within these relationships 'shift and slip'. Nevertheless, Docker states that "the dialectic looks to a transcendence of that which is opposed; the dialogic suggests spatial metaphors, the dispersal of conflicts and antagonisms into repetition and ambivalence" (1994, pp. xx-xxi).

Marcuse (1973) indicates links between dialectic theory and dialectical analysis.

Dialectical logic is critical logic: it reveals modes and contents of thought which transcend the codified pattern of use and validation. Dialectical thought does not invent these contents; they have accrued to the notions in the long tradition of thought and action. Dialectical analysis merely assembles and reactivates them; it recovers tabooed meanings and thus appears almost as a return, or rather a conscious liberation, of the repressed! (p. 538)

Plekhanov (1973) hypothesises on aspects of art and the dialectic that remain pertinent to this study at the beginning of the twenty-first century. Plekhanov contends that art develops in relation to movements in history and that "gifted persons appear" in response to favourable social conditions. However, he acknowledges "that such people" can "change only the individual aspects of events, not their general direction" (p. 120). In Solomon’s (1973) opinion, Plekhanov’s stance accords with the views of Marx and Engels (1976) who state, in The German Ideology,

Raphael as much as any other artist was determined by the technical advances in art made before him, by the organisation of society and the division of labour in his locality, and, finally, by the division of labour in all the countries with which his locality had intercourse. Whether an individual like Raphael succeeds in developing his talent
depends wholly on demand, which in turn depends on the division of
labour and the conditions of human culture resulting from it. (p. 417)

According to Solomon (1973), Bukharin adopted Bogdanov’s theory of
Tectology that “explains natural and social movement in terms of a dynamic
equilibrium whose unstable harmony is disrupted and then restored”, and adapted it
to the dialectic. Some Marxists doubted that Bukharin understood the dialectic.
Solomon insists that, for Hegel and Marx

the dialectical process involves both the unity of opposites and their
contrariety: the unity of opposites produces self-motion, whereas
for Bukharin and Bogdanov the origin of motion – being the product
of conflict between wholly antagonistic opposing forces – lies outside
of things, requiring a mechanical causative factor to bring it into
operation. In terms of a theory of art, Bukharin’s overemphasis on the
technological factor makes impossible the exploration of creativity, of
the inner dynamics of the art object, or of the active role of artistic
creation or audience response. (1973, p. 201)

Frow’s (1986) illustration of the dialectic is developed from the theories of
Althusser and Balibar, French structuralist Marxist theorists of the late 1960s and
early 1970s, and distinguishes between an ideological and a scientific basis of
theorisation, and, in my view, furthers Labriola’s “rhythmic understanding”. These
nuances of the dialectic are important to the research process as they encourage the
interpretation of movement of meaning within the text rather than an insistence on an
interjection from an outside source. Frow differentiates between the problems raised
in a text and “the horizon of the problems, the ‘problematic’, implicit in the texts
which are its raw materials” (p. 24). Althusser and Balibar imply, according to Frow,
that the intertextual relation, rather than the extratextual real, indicates not only that

which is missing from the prior text: it is rather a reading of the
necessity of this absence, of the relation between the “seen” and the
“unseen” which is constitutive of the limits of a problematic. It is
therefore concerned with the dialectic between the answers inscribed
within an ideological problematic and the questions which this
problematic cannot pose. (Frow, 1986, pp. 24-25)

Later, Frow allows that deconstruction is a form of dialectic but moderates
this statement with the observation that “the concept of dialectic is rejected by most
post-structuralist writers as being a form of that logic of identity which reduces
otherness to sameness in the very process of recognizing and incorporating the
In my view this is an unfortunate interpretation, as the dialectic does not search for, nor anticipate, sameness, but seeks a movement to a new or clearer understanding of a given set of circumstances. At the conclusion of his critique of Jameson and Eagleton, in which he claims that the latter's *The Rape of Clarissa* criticises deconstructive readings but moves towards Derridean methodology, Frow states:

The way forward, for Eagleton and for Marxist cultural theory, lies neither in a rejection nor in a complete accommodation of those varied languages called post-structuralism but in an acceptance of the challenge they offer to Marxism to rethink the status of the dialectic and to build a semiotic politics on the ruins of a metaphysics. (1986, p. 50)

A situation that does not lend itself to the dialectic is that of an 'art for art's sake' practice wherein aspects of meaning and purpose are unnecessary. Citing Pushkin's pessimism due to his censorship by Nicholas I, and, in France, the "insoluble" disaccord experienced by Jacques-Louis David (1748-1825) and his friends who worked to "put an end to the old order" prior to the "great Revolution" (1973, pp. 136-137), Plekhanov postulates: "the tendency of artists, and of those who have a lively interest in art, towards art for art's sake, arises when they are in hopeless disaccord with the social environment in which they live" (1973, p. 138). Following the revolution, David painted *Napoleon Franchissant les Alpes*, and *The Consecration of the Emperor Napoleon and the Coronation of Empress Josephine*, 1806-07. This particular interpretation of David led me to ask the participants whether they believed artists' feelings of disaccord with their social environment influenced the role of contemporary artists (see Chapter 4).

Williams (2001) translates Benjamin's idea of *correspondences*, which I interpret as a form of dialectic, as "an observable 'correspondence' between certain kinds of writing and certain other contemporary social and economic practices". Williams also observes that Benjamin and Adorno differ in their theorising of the dialectic in that Adorno pushes the "idea of mediation" (Williams, 2001, p. 256).

Adorno argued that correspondences of content, let alone reflections or mediations of content, are basically irrelevant to art. Indeed, the presence of such correspondences or reflections is virtually a guarantee that the art is not authentic. Art is produced ... by a process which he called the discovery of 'dialectical images', which had no
possibility of being discovered or expressed in any other form. The 'dialectical image' arose within the processes of art, and when created, although it might by analysis be related to the whole structure within which it was formed, was never overtly or directly related. Indeed the condition of its success as art was that it achieved an autonomous existence. (Williams, 2001, p. 256)

Lunenfeld (1999) uses the dialectic to examine the area of new media and observes that Adorno considers the dialectic as a "way to weld together identity and the contradiction of thought, unfolding "the difference between the particular and the universal". Digital technology, the focus of Lunenfeld’s text, operates on a duality or binary basis: 0 or 1, on or off, which, he claims, could be seen erroneously to resemble the duality of thesis and antithesis (p. xviii). He informs the reader that the essays in his book form screen grabs that "embrace ambivalence" [which] "contrary to what this might intuitively seem, is to sacrifice neither rigor nor sense. It is to lodge oneself in the dialectic, where reversals arc not simply expected but required" (pp. xiv-xv). The dialectical approach varies among contributors. It is seen by some "as a philosophical system, by others as a method of disputation, and by still others as an analytical tool" (Lunenfeld, 1999, p. xvii). Nevertheless, I interpret the book to be based, in the majority, on a dialectic of duality—one between theory and practice.

Eisenstein (1898-1948) applies the triadic dialectic in his silent movie Potemkin, 1925, an account of the mutiny by sailors at the port of Odessa, by using the principles of montage. For example, in one scene sequences are presented of the ill-treatment of the crew by an autocratic captain. An antithesis arises when the crew mutinies and their leader is killed. A synthesis is reached when the local populace embraces the crew and supports their action. The following scene sequences repeat this dialectical structure. Thus the plot is structured, through montage, around dialectical images with an emphasis on tension between ideas and situations. This method proves successful in building responses of apprehension and involvement in the audience.

In his discussion of stills from Eisenstein’s Ivan the Terrible, 1940-1943, Barthes (1983b) identifies disguise as an instrument employed by Eisenstein to create a third meaning. One example is that of Ivan’s beard where, in one still, it is used both as a referent to the Czar and as a visible artifice. In Barthes’ opinion, such a device creates a dialectic:
a multi-layering of meanings which always lets the previous meaning continue, as in a geological formation, saying the opposite without giving up on the contrary—a (two-term) dramatic dialectic that Brecht would have liked. The Eisensteinian "artifice" is at once falsification of itself—pastiche—and derisory fetish, since it shows its fissure and its suture. (Barthes, 1983b, p. 323)

In *The Eiffel Tower*, written in 1964, Barthes (1983a) demonstrates that the dialectic is a useful resource in literature. Barthes relates to the Eiffel Tower both as an observer looking at the tower, and as an observer looking from the tower. He transports the reader from the city and surrounds of Paris into the steel and human fabric which represents the essence of the famous structure. The synthesis of these two literal and metaphoric perspectives proffers a wider appreciation of the historical and contemporary roles of the Eiffel Tower in the lives of Parisians and tourists.

Paradoxically, although Barthes (1983a) writes that, like observers who cannot know their "own glance", "the Tower is the only blind point of the total optical system of which it is the center and Paris the circumference" (p. 237), he later attributes to it "both sexes of sight" (p. 238), and further: "Paris, in its duration, under the Tower's gaze, composes itself like an abstract canvas in which dark oblongs (derived from a very old past) are contiguous with the white rectangles of modern architecture" (1983a, p. 245).

More recent texts on art indicate a return to the notion of the dialectic as a comparison between binary factors without the intention of seeking a synthesis, or new level of understanding. Although some critics mention the term dialectic, they discuss the art works in binary values, or comparisons; for example, material and immaterial (Tousley, 2001), reason and emotion (Davis, 2001), artisanal and mechanical, intentional choice and aleatory chance (Buchloh, 2000), and the decorative and the metaphorical (McGillick, 2001).

In her critique of Eckart's paintings, which she describes in terms evocative of light, space, luminous depth, beauty, and work that "moves a contemplative viewer into the space of the inner self and, perhaps, beyond," Tousley (2001) warns that the contemporary art scene (excluding artists) may consider such a captivating journey "dangerous": "This might be one reason why, despite the revived interest in beauty, in the past decade, still so little serious attention is paid to it in the world of contemporary art. Except by artists, that is." McGillick is also aware of the
contemporary art scene's wariness of beauty. Concerning Borgelt, he writes: "Borgelt's art is formally sophisticated and rigorous, but it has achieved the condition of art more in spite of its luminous beauty and formal facility than because of it" (McGillick, 2001, p. 78). A renewed interest in beauty is canvassed in Chapter 4.

Tousley (2001) discusses another issue that she suggests reduces the "dialectical possibilities for contemporary art": Modernism's move away from the illusion of depth in painting to a flattening of the picture plane, a situation she describes as a move from the "feminine" and "beauty", to the "masculine" with its "counterparts such as 'strength', 'singularity' and 'autonomy'". Tousley's dialectical observation for art fits well with Barthes' dialectical observation for literature as outlined earlier. A dialectic between painting as illusion and painting as material fact concerns McGillick (2001), too. He observes that Borgelt sets up a dialectic between the illusion of depth generated by tonal gradation and the literalism of the shaped canvas in her paintings (p. 81).

Gigliotti (1999) posits that the dialectical method prevailing in Western thought needs revising:

We need a dialectic drawing upon the morally imaginative methods of Socrates, the grounding of ethical life in the cultural contexts of Ludwig Wittgenstein, and a disregard for contentious argument for its own sake.... What is needed is a dialectical process based on the goal of one position enlarging the other, offering it possibilities for improvement that an insider might never have guessed. (p. 52)

For a more evocative last word, I turn to Burnham (1980): "Dialectically art moves in Western culture towards the disclosure of the human psyche, which I would interpret as the life force unhindered by ego and self-consciousness" (p. 215).

In this study, I use the dialectic as an 'analytic tool' to examine the interactions between, as McLachlan, a research participant, would have it, 'the people' involved in the disciplines of science and art, their views and their practices.

Science and the scientist

As remarked earlier in response to Wolff's (1993) comments, scientists and science are becoming popular subjects for publications written for the non-scientific
community. A sample of these texts is reviewed here to give an insight into the role of science and the scientist in view of the collaborations discussed in the research. More specific updates on these issues are included in the relevant chapters.

The essence and role of a science community was the subject of Charlesworth's research at the Eliza Hall Institute. In his theoretical discussion, Charlesworth (1989) evaluates Kuhn's *The Structure of Scientific Revolutions* (1970) wherein Kuhn claims that science develops by revolutions, not "linear evolution", and that it is the scientific community that decides what to accept as science. Charlesworth adds that Kuhn assumes that the scientific community accepts his notion of a paradigm "instead of what might be called a 'dialectical' situation in which competing attempts to establish paradigms are vying for supremacy" (1989, p. 9). Indeed, Charlesworth stresses that Kuhn observes that science not only "takes place in a social context; he is making the more radical point that scientists themselves form a distinct community or sub-society which in effect defines what is and what is not to count as "science"" (pp. 9-10).

Kuhn’s hypotheses around the scientific paradigms attracted wide correspondence from his readers, to which he responded in a postscript in 1969. However, it is the relationship of Kuhn’s paradigms to his "novelties" or "revolutions" that I argue reflect on the role of both the scientist and the artist. Kuhn (1970) posits that novelties arise when a problem which "ought" to be solved by the usual means resists explanation, or when a piece of equipment does not work in the "anticipated manner, revealing an anomaly that cannot, despite repeated effort, be aligned with professional expectation" (p. 6). According to Kuhn, these anomalies or scientific revolutions lead to shifts in scientific commitment to the previous paradigm. "They are the tradition-shattering complements to the tradition-bound activity of normal science (p. 6). In my view, the link between Kuhn’s paradigm shifts, and his "revolutions", represents a form of the dialectic through complementarity. The novelties correlate with the ‘aha’ or ‘Eureka’ moments, or syntheses, described by both scientists and artists. The novelties also correlate with the idea of exploring the discards, a recurring theme.

Kuhn (1970) also has a view on the education of scientists and artists, noting that scientists concentrate on textbooks but, for artists, textbooks are secondary to the
“exposure to the works of other artists, principally earlier artists” (p. 165). He admits (in accord with others of his time):

I suspect ... that some of the notorious difficulties surrounding the notion of style in the arts may vanish if paintings can be seen to be modeled [sic] on one another rather than produced in conformity to some abstracted canons of style. (1970, pp. 208-209)

Dewey (1958) differentiates between the roles of artists and scientists in relation to “technique of thought and emotion”.

Those who are called artists have for their subject-matter the qualities of things of direct experience; “intellectual” inquirers deal with these qualities at one remove, through the medium of symbols that stand for qualities but are not significant in their immediate presence. (p. 73)

Shekerjian (1990) received a MacArthur Award and used the opportunity to interview other MacArthur Award recipients, including several scientists. The focus of her research was the creative impulse. She discovered some common themes. For example, scientists were driven and resilient; they were adept at creating an environment that suited their needs; they were skilled at honouring their own peculiar talents; they were capable of knowing when to follow their instincts; and they were “magnificent risk-takers” who were not afraid to run ahead of popular opinion (1990, passim). The extent to which these traits are valued in art and science circles is raised in my research interviews.

Wolpert (1989), who hosted the BBC Radio 3 programme, A Passion for Science, in the mid-1980s, found that many of his guests acknowledged problem-seeking tendencies, a feature seen as positive by Shekerjian and others. He asked Gunther Stent, a molecular biologist, for his opinion on the creativity of scientists and artists. Stent replied:

The world that the artists address is the inner world, so the fundamental difference between a scientist and an artist is that the artists address the inner world of the emotions, whereas the scientists address the act of discovery... [art] is similar to science in that it endeavours to discover truth. The artist endeavours to discover truth about the emotions, the inner world. It's not a question of tests or proof, but of validity, whether the experience seems valid to you or not. (cited in Wolpert & Richards, 1989, p. 117)
Summary

The literature discussed in this review provided a background for the compilation of the interview questions, informed my preparation for the research interviews which occurred during 2003, and assisted in the establishment of a framework within which to analyse the data from those interviews. Some topics, such as 'avant-garde' and 'beauty', are not addressed in depth in this chapter as the theory and art history surrounding them are so extensive and complex that space in this discourse does not permit sufficient attention. However, current debates on these and the other topics raised in this literature review are included, where appropriate, in the analysis of the interview data and the discussions that emanate from that analysis.
Endnotes


2 Bukharin wrote “What is art?” in Historical Materialism: A system of sociology (1921).

3 Dufrenne contends: “The word technè in Greek refers to any productive practice; it does not include distinctions made today under the headings of technique and art” (p. 165). Dufrenne, M. (1980). Art and technology: Alienation or survival? (C. Tennessen, Trans.). In K. Woodward (Ed.), The myths of information: Technology and postindustrial culture (pp. 165-170). London: Routledge & Kegan Paul. See also Bernard Smith’s comments, Chapter 8.


5 In a scenario where a reality is imploded, Chance the Gardener, the principal protagonist in Being There, a novel by Jerzy Kosinski (1977), and later a film, is forced by circumstances to leave the house, housekeeper, television, and walled garden which have constituted his entire existence, and to emerge into life on the American street. His reality based on television is replaced by a world of living people and hyper-reality. The plot develops as his social and intellectual disadvantages and banalities are interpreted by people close to the fictional President of the USA to be profundities.

6 Roy Ascott is Professor of Technoetic Arts and the Founding Director of Planetary Collegium, until recently known as the Centre for Advanced Inquiry in the Interactive Arts – Science Technology and Art Research (CAiiA-STAR), also at the University of Plymouth. Ascott is referred to in Chapter 5.


8 Zero@wavefunction would be an appropriate installation in the Gravity Discovery Centre, Gingin, Western Australia (see Chapter 6).

9 Christian Eckart is a Canadian artist who works in New York and Amsterdam.

10 Marion Borgelt graduated from the South Australian School of Art, and, upon completion, studied at the New York Studio School (1979-1980). In 1989 she was awarded a scholarship by the French government and, subsequently, spent eight years in Paris. Borgelt is the first Australian to be awarded a Pollock-Krasner Art Fellowship, and received an Australia Council Fellowship for 2001-2003.
CHAPTER 3

THE RESEARCH PARTICIPANTS

Science begins when men [sic] gauge the regularities found in sensation in order to learn the structure of the world. Art begins when they recreate sense patterns, using sounds and images to preserve past experiences and to enrich the present. (Kepes, 1956, p. 103)

Introduction

The enthusiastic and conscientious participation of the thirteen interviewees involved in this study has provided insights and topics that have given added dimensions to my research into the role of the contemporary artist. Although their contribution is acknowledged previously, I would again like to emphasise the generous and good humoured manner in which they agreed to take part, and the cooperative attitude they brought to the interviews. Without exception, the interviewees were positive and supportive when asked to participate, despite their onerous responsibilities and the heavy demands on their time. Some were reticent at first, not from lack of interest, but from a concern that they would not be able to contribute sufficiently to the research. Their concerns were unfounded.

In addition, I wish to acknowledge the extensive preparation the majority of the interviewees undertook after receiving the questions and prior to the interview taking place. They approached the interview with notes for responses to individual questions, and details of items of interest that they considered would add to the dialogue. My sincere thanks and appreciation are extended to them all.

This chapter sets out information on aspects of the participants' professional careers that influenced the decision to invite them to take part in the research. The interviewees are listed in alphabetical order. Descriptions and reviews of the participants' art works, or art works on which they have collaborated, are provided.
and, in addition, websites are listed to facilitate access to images and additional information, where appropriate.


Jason Benjamin, a full-time professional painter who has not collaborated with a scientist, resides in Sydney. His art education includes a period, 1989-1990, at the Pratt Institute, New York City. Benjamin is represented in Australia, London, Tokyo and Hong Kong. He has won the Kings School Art Prize and the Mosman Art Prize (three times), and has work in numerous public and private collections. Benjamin finds inspiration in the paintings of Diego Velasquez and other seventeenth century masters. During the interview, Benjamin expressed the "undeniable and indescribable magic and wonder", the essence, of great works of art he sensed when viewing the original masterpieces after previously having seen them only in reproduction. Solomon (1973, p. 270) cites magic as "inherent" in art, see Chapter 2. His own large, intense canvases are infused with metaphor and beauty, and have pithy, thought-provoking titles. The images are based in realism but evoke metaphysical overtones. Some of the descriptors Thomas (2003) uses for Benjamin's paintings include "extraordinary realism, which he clothes in colours of ravishing beauty", "metaphors abound", and "these paintings, so rich in their realism enveloped in an atmosphere of utter stillness, remind me of the great German Romantic landscape painter Caspar David Friedrich" (2003, unpaginated). The Australian Art Collector magazine nominates Benjamin among Australia's top fifty most collectable artists, and his recent exhibitions have been opening night 'sell outs'. He is the youngest Australian painter to sell a work for over A$50,000. Benjamin's daily experiences of the role of the full-time professional artist in twenty-first century society add an informed artist voice to this study. His paintings can be viewed on:

- http://www.greenillgalleries.com/previous-exhibitions/jason-benjamin/


SymbioticA, the Art and Science Collaborative Research Laboratory, was established in April 2000 within the University of Western Australia’s School of Anatomy and Human Biology. The first research laboratory of its kind, it offers artists opportunities to engage in wet biology practices within a biological science department. The laboratory promotes the artistic exploration of scientific knowledge and developments, and the artist in residence programme is open to artists with or without training in the sciences. However, the management of SymbioticA believes that artists need to engage actively with the tools and technologies of science to enable them to enter the discourse about scientific and medical technological advances. Another example of Bunt’s interdisciplinary approach is his co-founding of the Image Acquisition and Analysis Facility, also at the University of Western Australia (UWA).

Bunt is one of the collaborators in MEART, (multi-electrode array art), a bio-cybernetic installation project, which has interdisciplinary and international crossovers and involves the SymbioticA Research Group, comprising Guy Ben-Ary, Phil Gamblen, Stuart Bunt, Ian Sweetman, Oron Catts, Ionat Zurr, Gil Weinberg and Matt Richards. Professor Steve Potter and his laboratory team at the Georgia Institute of Technology, Atlanta, are also involved in the MEART project. MEART is described as a semi-living artist, assembled from wetware, hardware, and software. Its ‘brain’, composed of living neural cultures, was cultivated in Atlanta. When exhibited in Western Australia, “the electric signals from a culture of embryonic rat cortex grown over Multi Electrode Array (MEA) in a Georgia lab controlled, in real time, the robotic drawing arm in Perth”. This drawing ‘arm’ made “visual art” marks on sheets of paper with coloured pencils. The MEART project was originally titled Fish & Chips, and the personnel involved assert that “by creating a temporal ‘artist’ that will perform art-producing activities, ‘Fish and Chips’ explores questions concerning art and creativity” (SymbioticA, 2002). MEART has been exhibited at BEAP 2002, Australian Centre for the Moving Image (ACMI), Melbourne, 2004,
Comprehensive explanations and illustrations are available at the following sites:

- http://aribots.org/2003/participants/MBART/

Bunt's active promotion of a dialogue between science, art and society in public and government arenas places him in an appropriate position to inform many areas of this research.


Susanna Castleden, BA (Art) Honours, MA (Visual Arts), is a practising artist and Co-ordinator of Printmedia, Curtin University. Castleden has not engaged in a sci-art collaboration. Her recent exhibitions focus on the manner in which language is used to discuss landscape and territory in terms of place and mapping. Maps of Australia formed and informed by mapping pins, metal tags, tape and screenprints are the aesthetic basis on which many of her cultural concerns are expressed. In her recent exhibition, Souvenir, 2004, Castleden's elegant, achromatic screenprint overlays, and a creative use of mapping pins, evoke a sense of presence and stillness as they remind the viewer that human structures, such as wells, mines, airfields and out-camps, once abandoned, are merely souvenirs in the Australian outback, now reclaimed by the spread of wildflowers. Her work can be seen at:


Castleden maintains a strong interest in Australian and international art, and brings up-to-date information, and personal experience of the role of the contemporary artist, to the research.


Oron Catts, BA (Design) (Honours), MA (Visual Art), is a co-founder and the Artistic Director of SymbioticA. Ionat Zurr, BA (Honours) is currently a PhD
candidate, researching the ethical and epistemological implications of wet biology art practices, and is an artist in residence at SymbioticA. Catss and Zurr are co-founders of the Tissue Culture and Art Project [TC&A], established in 1996 at SymbioticA, and were Research Fellows at the Tissue Engineering and Organ Fabrication Laboratory, Harvard Medical School (2000-2001). Catss and Zurr were interviewed together and are counted as one entity. Their ground-breaking work has been exhibited at many national and international exhibitions and they are in demand as speakers for conferences and other public functions.

Catss and Zurr research and practise the use of tissue technologies in the development of their art installations which, in some cases, are referred to as 'semi-living'.

The goal of this work is to culture and sustain for long periods tissue constructs of varying geometrical complexity and size, and by that process to create a new artistic palette to focus attention on and challenge perceptions regarding the utilization of new biological knowledge. (Catss & Zurr, 2002, p. 365)

Their projects include Victimless Leather, Extra Ear – ¼ scale, Disembodied Cuisine, The Pig Wings Project, and ‘semi-living’ Worry Dolls. Victimless Leather is a project in which cultured “immortalised cell lines form a living layer of tissue supported by a biodegradable polymer matrix” formed into a “miniature stitch-less coal like shape” (Tissue Culture and Art Project, 2004a). Their collaboration with Stelarc, Extra Ear, is discussed in Chapter 5.

Disembodied Cuisine was first created in 2000, using pre-natal sheep skeletal muscle and a degradable PGA polymer scaffold. The artists state that it “was the first attempt to use tissue engineering for meat production without the need to slaughter animals.” In 2002, Disembodied Cuisine was exhibited at Nantes, France, using frog skeletal muscle. The material was derived from a biopsy taken from a frog that continued to live and be displayed in the gallery alongside the growing “steak”. The product was eaten at a “feast” at the end of the exhibition. The artists note their concern that “by making our food a new class of object/being – a Semi-Living – we are risking making the Semi-Living the new class for exploitation” (Tissue Culture and Art Project, 2004a).
The Pigs Wings were created by cultivating pig bone marrow stem cells into miniature models of wings. The artists developed three different wing shapes: the angelic, a bird wing; the horrific, a bat wing; and the obsolete, a dinosaur wing. The 'semi-living' Worry Dolls were created in response to the Guatemalan Indians' legend in which they teach their children to tell their worries to a special doll at bedtime, with the anticipation that the doll will solve their worry overnight.

Our worry dolls were hand crafted out of degradable polymers (PGA and P4HB) and surgical sutures. The dolls were sterilized and seeded with endothelial, muscle, and osteoblasts [sic] cells (skin, muscle and bone tissue) that are grown over/into the polymers. The polymers degrade as the tissue grows. As a result the dolls become partially alive! Will they take our worries away? (Tissue Culture and Art Project, 2004b)

Illustrations and in-depth explanations of these projects, and others, can be found at numerous sites including:


Catts and Zurr proved invaluable inclusions for this research due to their high profile in sci-art, bio-art, or moistmedia, world-wide.


Peta Clancy, BFA (Media) (RMIT), BFA (Honours) (University of Tasmania), MA (Media Arts) (RMIT), is a practising artist, and a PhD candidate (Monash University, commenced 2003). Clancy is included as an artist who collaborates with scientists. In 2001, she was an artist in residence at SymbioticA.

Part of the work undertaken during Clancy’s ten day residency at SymbioticA was incorporated into Body Manufacture, a project for the Next Wave Festival, 2002, in Melbourne. Body Manufacture was an Austrian and Australian exchange, funded by Film Victoria and the Government of Austria. Clancy participated in Our Perfect Dream, an Austrian/Australian art exchange, in Salzburg, in 2001. For Body Manufacture, the artists decided to research genetics, a common interest, but each artist contributed to the collaboration from his/her own area of practice: for example.
Clancy's interest was medical imaging; and Kranawetvogl's interest was fashion and consumerism. Clancy was unable to have her chromosomes imaged in Melbourne, as it required having blood taken for non-medical reasons. She declined images of other people's chromosomes. Fortunately, through SymbioticA, Clancy was able to access her karyotype in Western Australia. *Body Manufacture*, an installation, comprised several components including sound, architectural/sculptural elements, digital images and animation, all originating from the molecular structures of the human body. An inflated architectural structure was based on Clancy's chromosome data. During the Next Wave Festival, in 2003, Catts and Zurr, Clancy, and a scientist from Murdoch Children's Research Institute (MCRi), in Melbourne, gave a presentation about their work.

In 2002-2003, Clancy gained further experience in working with scientists during a residency in the Cell and Gene Therapy Laboratory, at MCRI. Her residency was funded by Arts Victoria, and the New Media Arts Board of the Australia Council for the Arts, to work on the project *geneware*. The scientists at MCRI research gene therapies and diseases such as thalassaemia and Friedreich ataxia, and Clancy's time there provided her with a rewarding learning experience. In *geneware*, Clancy explored developments in genetics and biotechnology.

Clancy asks "In the future, how will biotechnology influence our relationships with our bodies?" During her residency at MCRI, in 2003, Clancy developed *Visible Human Bodies*, work that comprises "living" drawings "made using different bacteria grown on nutrient agar in Petri dishes". When the drawing is finished, "the bacteria cultures are then incubated in an environment conducive to growth for several days." In this way, Clancy uses the human body "symbolically to reflect on fears of biotechnology" (Clancy, 2003).

In 2004, Clancy was awarded a three month residency in London, funded by the Wellcome Foundation. During her London residency, she created *Sweetie*, a body of photographic and video works, in which "bodily materials and other substances are used as metaphors for the transformative, reproductive and regenerative process of the human body" (Clancy, 2004). Clancy has been invited to present a solo exhibition, *Visible Human Bodies*, at the Brighton Museum and Art Gallery, UK, during the Brighton Festival in May, 2005. Other high profile artists to exhibit at the
Gallery during 2005 include Richard Billingham, Zaina Bhimji, Tracey Emin, and Isaac Julien. Images of Clancy’s work can be found at:


Robert Cleworth, BFA (Australian National University (ANU)). Cleworth resigned from his position as Co-ordinator of Visual Arts, Edith Cowan University, Bunbury campus, Western Australia, to commence a Masters degree at Curtin University, Perth. He has not been involved in a collaborative work with a scientist. His awards include the inaugural Samstag International Visual Art Scholarship in 1993, and in 1993-1994 he attended the Glasgow School of Art, Scotland. He is a consistent exhibitor in Canberra, Sydney, and Western Australia. Cleworth’s painting explores the nature of sexuality as it is represented through the pornographic and painted image. Notions of painterly craft and skill, and references to, and the use of, pornographic imagery are integral elements of his work, but they are also only points of departure. Cleworth’s frequently confronting sexual imagery is juxtaposed with landscapes or abstract fragments, and is painted with great sensitivity, often resulting in a tantalisingly rich surface. He maintains a scholarly and practical relationship with fine art and provides an excellent art-based balance for the research. Images from his exhibition at Legge Gallery, in 2003, can be viewed at:


Joanne Edmondston, BSc (Murdoch), MPH (Curtin), combines her current PhD research in the area of science communication with lecturing in biotechnology. When initially approached to participate in this research Edmondston had not collaborated with artists. However, in the three weeks between the initial approach and the interview, she contacted two artists and submitted a proposal for Australian Research Council (ARC) funding for a collaborative project in the science communication field. As no work on the project had commenced, I retained
Edmondston in the group of scientists who had not collaborated with artists. Her special interest in the communication of science informs my research.


Richie Kuhaupt, BA (Fine Arts) (Honours), MA (Visual Arts), is a full-time professional artist. Kuhaupt is included in this research as a sculptor who works with biologically based forms. In particular, it was his installation with Drake-Brockman at BEAP, 2002, which drew him to my attention. Kuhaupt is an honorary member of the Royal Society of British Sculptors. Kuhaupt and Drake-Brockman are the artists Edmondston approached in instigating her proposed collaborative project. Kuhaupt was a joint winner of the Sculpture by the Sea, 2000, and images of his winning work, Hollow Man, and his work in BEAP, Chromeskin, can be seen at:


http://www.sculpture.org/documents/parksdir/p&g/sea/sea82.htm

http://www.drake-brockman.com.au


John Long, PhD (Monash), was the Curator of Vertebrate Palaeontology at the Western Australian Museum at the time of the interview. In October 2004, he was appointed to head the Scienceworks Museum, at Museum Victoria. Although Long frequently engages artists to assist in the visualisation and illustration of his scientific discoveries and his books, he has been included as a scientist who does not specifically collaborate with artists on distinct science and art developmental projects. Long is a distinguished author of books, articles, and scientific papers, and a high profile contributor to public discussions on science. His work in making science more accessible to the public was recognised with the 2001 Eureka Prize for the Promotion of Science. He is particularly noted for his leadership of the team that researched one of Australia’s biggest fossil finds on the Nullarbor, in 2002. Long’s broad experience and enthusiasm for the dissemination of scientific knowledge to the wider community equip him to contribute substantially to the research.

At the time of the interview, Steve Meikle was the Principal Scientific Officer (Physics) in the Department of Positron Emission Tomography (PET), Nuclear Medicine, Royal Prince Alfred Hospital. He is now Associate Professor, School of Medical Radiation Sciences, University of Sydney.

Meikle approached the Sydney Regional Scientific Visualisation Laboratory (Sydney VisLab) to explore better ways to visualise and to aid the interpretation of the data generated from PET. From 1992 until 1994, Patsy Payne was also accessing Sydney VisLab for her art work. Through this connection, a collaborative work, Hypochondria, was created. Payne manipulated the raw data from a series of PET scans of her body, on a supercomputer at the Australian National University. In this way, Payne redefined her body by taking the ‘objective’ data from the scans and representing them as a range of sensations, memories and experiences. “Patsy presents an internal self-portrait that is projected on to the gallery walls. Audiences will be able to stroll inside Patsy” (Payne, 2004). Meikle’s and Payne’s work can be seen at:


http://www.abc.net.au/arts/heads/pace/special/patsy/default.htm

Meikle contributed a major insight to the research by pointing to a future role for the artist within a science and art collaboration (see Chapter 11).


A developmental biologist, John McLachlan was awarded a Personal Chair (Medical Education) by the University of Exeter in June 2003. In the same year he was awarded a National Teaching Fellowship (£50,000) for excellence in teaching. This Fellowship acknowledged the innovations McLachlan brought to the teaching of medicine as a result of his awareness of the ways in which art could assist his medical students in their studies; an awareness he developed following his interdisciplinary collaboration with the artist Professor Helen Storey. McLachlan has won many research grants and awards, but what is dear to his heart is a
prestigious SciArt Consortium Development Award for £370,000 in recognition of a collaborative exhibition, Mental, with Storey. BZ Reaction, an installation in which the audience could perform structured experiments with non-hazardous chemicals in a simulated laboratory setting, was conceived by McLachlan for Mental. The Helen Storey Foundation website describes BZ Reaction as a “large scale public experiment [that] takes place in a minimal gallery/laboratory. Three underlit troughs of liquid are employed to display each individual experiment.” BZ Reaction is based on an experiment developed by Belousov and Zhabotinsky, the outcome of which does not follow the second law of thermodynamics, and is random and “defies explanation”. The website also claims that: “The importance of the existence of such phenomena within the dialogue of Mental is their ability to dissolve boundaries between art and science. Scientists cannot explain everything, and in the BZ exhibit the artist is similarly rendered useless” (Helen Storey Foundation, 2003). Gerber (2001) notes that Dr McLachlan will use data gathered from the BZ Reaction exhibit experiments to further his genetic research. Chapter 6 contains further details of the collaboration between Storey and McLachlan. Information on the components of Mental, BZ Reaction and Death Dresses, is available at:

http://www.helenstoreyfoundation.org/bzreaction.html

http://www.cyrmagazine.com/review.php?id=2&rid=20

http://www.kcl.ac.uk/phpnews/wmprint.php?ArtID=292

McLachlan’s knowledge of the funding opportunities and arrangements for science and art collaborations, and his personal involvement in a sci-art exhibition which travelled internationally, enabled him to contribute substantially to this research.


Fiona Nicholls, BNatRes (Honours), MBA, has taken her science and business degrees into the world of mining where she has applied them to issues concerning the environment and sustainability. Her present position is General Manager – Sustainable Development, Energy Services, for a global company with extensive and varied interests. Constant global travel has enabled Nicholls to experience many cultures on a person to person level, and to access a wide diversity
of museums and art galleries. Nicholls' career has taken her from leading mining exploration teams in outback Australia, to remote mine sites world-wide, to corporate boardrooms. Due to her depth and breadth of experience in the wider community, and her keen interest in art, Nicholls was in a position to respond to the research questions from many perspectives.


Patricia Piccinini, BA (Economic History) (Australian National University), BA (Painting) (Victoria College of the Arts), was Australia's representative at the 2003 Venice Biennale. Piccinini's art practice has received extensive media coverage. For this research, Piccinini has been included as a biotechnologically based artist because, although she has not collaborated with scientists, her productions are frequently based on biological forms and represent imaginary versions of stem cells and other scientific or medical phenomena. Nevertheless, Piccinini was adamant that she does not regard herself as a biologically based artist, and questioned my use of the term 'biologically based art' to delineate any art practice as, in her view, categorisation is unnecessary. It is not my intention to categorise artists as practitioners in any particular area, as artists usually defy such attempts, but the term is used as a means of identifying certain artists and practices for the purpose of this research.

Piccinini initiates the ideas for her art work but employs experts in the necessary areas of practice to bring her ideas to fruition. Hutas (2001) notes that "Piccinini says her work requires a team of people, and she is careful to always credit anyone who has contributed to the production of a work" (p. 65). However, Vakras (2004) argues that those "with whom she collaborates remain largely unknown and only one person is promoted as the creator, exhibitor and artist", the exception being when Piccinini's husband, Peter Hennessey, exhibited with her in Adelaide, in 2004. Strickland (2003) reports that Piccinini's dealer, Jane Minchin, "is keen to dispel any notion that Hennessey is a dual creator of her client's work, but acknowledges his pivotal role in Piccinini's life and in the creation of her art" (p. 16). Hennessey has been a member of the Australia Council's New Media Arts Board since 2000. Piccinini's website provides a comprehensive coverage of her prolific art practice.

http://www.patiapiccinini.net
Endnotes

1 "In PCT, multiple sections of information stacked back-to-back, like slices of bread, are taken throughout a particular area of interest e.g. brain, heart or whole body to give a three dimensional display of function in-vivo" (Central Sydney Area Health Service, 2004)

2 Sydney VisLab is 'the leading-edge site in Australia for advanced computing and scientific visualisation'. The central laboratory is located at the University of Sydney.
CHAPTER 4

CONTEMPORARY ART PRACTICE

Modern art has made clear what before was only suspected or hinted at — that the worth of a work of art depends not on one's taste for it, nor on the respect which it displays for the exterior world or for tradition, nor on its qualities of ornament or entertainment, but on what is proper to itself, expressed by its own proper means. (R. Berger, 1963, pp. 11-12).

Introduction

This thesis does not attempt to answer the question "what is art?" However, in order to explore the comments and ideas expressed by some of the participants about art in general, and more traditional contemporary art practices in particular, this chapter examines several components that contribute to the essence of art. This chapter also provides an overview of what the act of art-making means to artists, and studies the extent to which participants believe art works play a part in the discussion of social and cultural issues.

During the course of the research interviews, the participants commented on various topics that were not signalled in the questions: for example, the increased commentary on beauty in contemporary art; the correlation between fashion and art; the influence of art dealers and art auction houses; and the current education regimes for secondary and tertiary visual art students. Some of these issues are addressed in this chapter.

The use of the term 'contemporary' in relation to art is discussed in Chapter 10. 'Art for art's sake' is discussed in this chapter and, although in the research question art for art's sake is described as a practice "wherein aspects of meaning and purpose are unnecessary", participants brought their own interpretations to the interview. In so doing, they validated the assertions of many qualitative theorists on
the use of semi-structured interviews, as outlined in Chapter 1, and added another dimension to the research.

Art's elusive essence

As Long would have it, art comes from the "classical side of the mind" and is required "to create something new in order to present something that has not been seen before". Instances of insightful artists are discussed in Chapter 11. Long's idea equates with that of Baudelaire and Mayne (1995): "Painting is an evocation, a magical operation" which makes its effect by means of a fusion of colour and line, and which has its own principles of life, to be found nowhere else but in the "soul" of the artist (p. xviii). Iris Murdoch, one of the fifteen 'men' interviewed in Magee and Berlin's *Men of Ideas: Face to face with fifteen of the world's foremost philosophers*, claims that:

"art is close dangerous play with unconscious forces. We enjoy art, even simple art, because it disturbs us in deep often incomprehensible ways; and this is one reason why it is good for us when it is good and bad for us when it is bad." (Murdoch, cited in Magee & Berlin, 1979, p. 269)

Tilghman (1984) concludes that, for him, the "very idea of a theory or definition [of art] is a confused one" (p. 187). He draws attention to the quantitative and qualitative distinctions between the "senses" or "uses" of the phrase "work of art" expounded by theorists such as Pepper, Weitz, and Dickie (Tilghman, 1984, p. 48). Dickie's (1974) definition of a "work of art" is structured in terms of "artfactuality" and the work's "conferral status of candidate for appreciation" (pp. 33-34).

A work of art in the classificatory sense is (1) an artefact (2) a set of the aspects of which has had conferred upon it the status of candidate for appreciation by some person or persons acting on behalf of a certain social institution (the artworld). (Dickie, 1974, p. 34)

Dickie (1974) goes on to recognise the problems inherent in defining who confers the status of art upon a work, who comprises the art world, and what is meant by "appreciation". He suggests "all that is meant by 'appreciation' in the definition is something like 'in experiencing the qualities of a thing one finds them worthy or valuable'" (p. 40).
René Berger (1963) and John Berger (1972) are aware of the value and integrity retained in a painting. René Berger expresses it as what is 'proper' to the art itself, see epigraph above, and, for John Berger, original paintings manifest a “silence and stillness [that] permeate the actual material, the paint, in which one follows the traces of the painter's immediate gestures” (J. Berger, 1972, p. 31). They identify the experience of many artists with whom I have spoken who sense that these traces of the painter's hand and time invested in working on a painting reside within the work, and enhance the perceptive viewer's affinity with the result.

This outlook regarding time invested in art work differs from that of Caves (2000) for whom economic issues are paramount. “Time is of the essence”, writes Caves. He cites the film industry and the dependence of creative projects on the timely co-ordination of production and financial return, a factor he calls the "time flies property" (p. 8). Artists suffer acutely from Caves' "time flies" problem: their frequently delayed recognition results in loss of possible financial and other, intangible, returns. The film entrepreneur will benefit from continuing royalties, but the artist will probably receive a very small sum for an art work's initial sale, and its increase in price over the years will benefit others, not the artist.

Benjamin suggests mystery operates in art and he reveals that he has experienced a transcendental quality when viewing "great art", such as original old Masters. Einstein (1954) observed that "the most beautiful experience we can have is the mysterious. It is the fundamental emotion which stands at the cradle of true art and true science" (p. 11). Briskman (1985) agrees and surmises that the problem "is emphatically not to remove all the miraculousness and mystery from creativity, for that would remove creativity itself. Rather, it is to try to explain how creativity is possible, without making it necessary" (p. 132). Benjamin suggests that Picasso's Guernica, 1937, is one of the great creative works of art that deals with a challenging issue but retains sufficient mystery to prevent limiting its horizons. It is the title, rather than anything specific in the painting, that points to Guernica, "because clearly it is not just about Guernica, it is a broader brush stroke."

Another aspect of mystery in the arts is the influence of the muse, or inspiration, as reported by many musicians, writers, scientists and artists. McLachlan prefers the French term, opéryu, a insight. Briskman (1985) records that some have proclaimed themselves surprised by their own creative achievements. Nevertheless, it
is necessary to relate to the created products to comprehend the creative process, according to Briskman, and, in this regard, it is the preparatory work which impinges on the process: the scientist's thoughts and conjectures, and the artist's initial strokes upon the canvas.

The creator, in his [sic] very process of creation, is constantly interacting with his own prior products; and this interaction is one of genuine feedback, for the creator is as much influenced by his own initial creations as these were influenced by him. (Briskman, 1985, p. 139)

In an attempt to define a creative product, Briskman arrives at the following essential characteristics: first, it needs to be novel in relation to its background and prior products; second, it needs to solve a problem in relation to, and that emerges from, its background; third, it needs to "actually conflict with parts of this background, to necessitate its partial modification, and to supplant and improve upon parts of it"; and, fourth, it needs to be "favorably evaluated" in relation to its background. Such a product could be termed a "transcendent product", says Briskman (1985, p. 144). Briskman's transcendent product could, in some instances, represent a dialectical relationship; the background or status quo is disturbed by an antithesis, the transcendent product, culminating in a synthesis whereby the creative artist or scientist "transcends himself", as Briskman puts it, see Chapter 2.

Art from a new media perspective

The Australia Council, the Planetary Collegium and other funding bodies consider biologically based art to fit within the parameters established for new media due to sci-art's close association with new scientific, medical and digital technologies. New media commentators, therefore, include biologically based art as part of their remit, a remit that incorporates constant change.

Smith (1988) argues that three periods of major change in western society's methods of production have correlated with periods in which "the culture-hero and his legitimate heir, the artist as hero, has flourished" (p. 9). The first occasion was associated with the beginnings of technologies, such as fire, as portrayed in the Greek myths of Prometheus and Daedalus. The second occasion occurred between 1425 and 1525, another period of technological change. At that time, new "rules"
developed for artists and it was "required that each unit of an artist's production should differ significantly from a previous unit; that it should solve a problem, or reveal personal originality" (1988, p. 13), a circumstance described by Briskman (1985, p. 139). The third occasion was associated with the technological advances of the industrial revolution and the political upheavals of the late eighteenth century. However, by the late nineteenth century, as Smith would have it, artists "tended to avoid active participation in politics", or "kept it out of their art. It is the time of the technical hero" (1988, p. 25). Smith claims their position responded to Kant's aesthetic theory "that an aesthetic judgement was at once personal, universal and disinterested" (1988, p. 25). For Kant, "Fine Art and the sciences, if they do not make man morally better, yet by conveying a pleasure that admits of universal communication and by introducing polish and refinement to society, make him civilised" (cited in B. Smith, 1988, pp. 25-26).

Smith believes that, in Picasso, we have an example of the end of the artist as hero. Picasso, according to Smith, kept his politics and his art separate, a situation typical of the separation of art and moral action recommended by Kant (1988, p. 27). Cattez and Zurr assert that the purpose of their art practice is to provoke debate about the moral and ethical issues surrounding recent biotechnological developments.

Experimentation and the incorporation of new technologies in art has tested philosophers of art, reports Wilson (2002). He cites the notions that "art is intentionally made or assembled by humans, and usually consists of intellectual, symbolic and sensual components" as meeting with general consensus, while a clear definition of art, aesthetics, the role of "expression", and "criteria of evaluation" all remain elusive (Wilson, 2002, p. 17).

According to Heathcote (2003), the cyclical argument that painting is dead, and that it has been surpassed by new media, re-ignited by Geezy (2002a), is a matter of semantics and rival positions. Heathcote (2003) evinces surprise about the negative response to the inclusion of graffiti in a book he co-authored, *Australian Painting 1788-2000*. In many locations in Australia, painting "has been reinvented in a brash new manner - I refer to urban graffiti". He counters Geezy's (2002a) article on the 'death of painting' and points out that changes in art fashion are led by tastemakers and that innovative painting "may be out of fashion in the museum, but in the real world painting still packs a punch" (Heathcote, 2003, p. 13). This is the
vision of the Australian Centre for Concrete Art (AC4CA). Its members develop projects to paint and convert external walls and car parks, mainly in Fremantle, Western Australia, into a fresh visual environment. Group leader, Goddard, predicts that their activities will heighten interest in "the role of art and its contemporary articulations" (cited in Snell, 2004, p. R19).

In response to Geczy, Timms (2004b) reminds his readers that, for those of a European heritage, "painting works metaphorically. It is vertical and associative" (pp. 20-21). The inherited influences are triggered by "cultural connectedness" that brings with it knowledge, of "the basic mythologies of the culture in order to understand not just what is being conveyed by a painting, but also the manner of its conveyance, for the two are inseparable". Timms also points out that paintings have an historical context, "they contain traces of memory". On the other hand, he asserts, and as some of the research participants have emphasised, new media do not have a long history on which to draw, but Timms suggests that this could have both positive and negative implications (p. 21). New media originate from the technologies that unfolded during the second half of the twentieth century. The lack of history, as a curatorial concern, is discussed in Chapter 5. Timms also addresses the argument that new technologies "are seen simplistically as being in opposition to traditional media and, by inference, superior, because more up to date (which itself suggests a conservative belief in technical progress)" (2004b, p. 22). (See also Wilson (1993; 1996; 2002).

Wilson (2002) associates technological developments in reproduction and ephemeral art works with the loss of 'aura' of art work, and claims "timeless masterpieces" might no longer be possible. In particular, he regrets that the computer based art work he produced in 1988 is now "quaint and archaic" due to more recent technological developments. He proposes that a new definition will be necessary for 'masterpiece' (pp. 30-31).

Think of a masterpiece as a work of art that seizes the cultural moment, or as a work that senses the cultural leap represented by a line of research and uses the magic of the arts to expand what it means and explores what it might become. After the moment passes, the masterpiece will have served its place in history. Like landmarks in science, such as Galileo's [sic] new vision of the universe, these artworks' timelessness is their audacity, even though the new ground they break may become common ground. (Wilson, 2002, p. 31)
As is to be expected, Wilson's worldview is biased towards art associated with all forms of technological advances, and leaves little room to manoeuvre for artists with a wider appreciation of art of all genres. In this he is supported by Wolpert (2002). Painting is the least likely of the arts to connect with science, he asserts, because it does not deal with complex ideas or explanations, is the easiest to appreciate, and the response is often an emotional one. Ideas in art come from art critics and historians, not the works themselves. Unlike the second law of thermodynamics, population genetics or quantum mechanics, which require much basic knowledge to appreciate properly, the response to a painting needs no prior training—though it can increase appreciation and pleasure. I cannot understand what is being referred to when there is reference to critical thinking in art. (Wolpert, 2002)

Hofmann (1993) claims "The only values which make a work of art great are emotional and sensory. Life-content. Expressed experience" (p. 355). Here lies a conundrum. I contend that Hofmann's assessment integrates the qualities Wolpert acknowledges exist in painting, such as ease of appreciation and an emotional response, and those he decrees do not, such as complex ideas and critical thinking that are developed extensively through life experiences.

Is 'beauty' being rehabilitated?

A deep engagement with the historical debates regarding beauty conducted by philosophers, such as Baumgarten and Kant, is beyond the scope of this thesis. However, as one participant in particular considered beauty an important contemporary subject, it is discussed briefly in relation to recent texts. For Benjamin, beauty (a quality he assured me is very different from decoration) is the ultimate aim in his paintings, an aim, he adds, that is hard to achieve. "Beauty is not just shallow decadence, beauty can have real pain in it, perhaps a sad kind of happiness ... it is not eye candy", or it can range to the beauty that is "in nature". His view is expanded upon in Chapter 11. Wolfgang Laib asserts that "beauty [but not naïve beauty] is something that is very important for now and for the future", and that many artists are "very afraid of beauty" because our society is surrounded by "so much ugliness". Laib feels that the natural materials he uses for his art work, such as milk, beeswax and pollen, are of "an incredible beauty in which we can participate".
and which offers infinite "possibilities for our future life" (W. Laib, personal communication, February 15, 2005). Tousley (2001) also contends that contemporary artists may consider "dangerous" a journey into the contemplative that includes beauty (see Chapter 2).

It is worth noting here that Benjamin's exhibition profile is growing as is that of other artists whose works evoke associations with beauty. Reid (2002) advises his readers to be efficient in their art collecting strategies and to ensure that they are on the dealer's preferential mailing list for any artist they target for collection. As an example, Reid cites Benjamin's exhibitions and assures his readers that, although some artists' works may attract a lower price in a smaller marketplace, Benjamin's do not fall into that category (Reid, 2002, p. 36).

In an academically crafted catalogue essay on the work of Tim Maguire, Biemoff's (1999) final sentence reads: "perhaps in the end, it is the sheer beauty of Maguire's painting that makes one look, a second time, at painting itself". A heightened interest in aspects of beauty is also evident in French's catalogue essay for Dale Frank's exhibition, Before Beauty, 2007.

Benjamin connects with the magic and wonder apparent in great art and contends that these qualities are "undeniable" but also "undescribable". His views echo Ernst Fisher's assertion as reported in the literature review: "Art is necessary in order that man should be able to recognize and change the world. But art is also necessary by virtue of the magic inherent in it" (cited in M. Solomon, 1973, p. 270). Gertrude Stein's circle thought a work of art dead if it were called beautiful, says Sontag (2002), who points out that such a stance did not necessarily indicate a decline of the authority of beauty. Rather, it testifies to a decline in the belief that there is something called art" (p. 22). Culture wars during the twentieth century led to the notion that 'interesting' was a more appropriate euphemism for art than 'beautiful', but Sontag suggests that "connoisseurs of the interesting -- whose antonym is the boring -- appreciate clash, not harmony". She asks: "Imagine saying, 'That sunset is interesting'" (p. 26). Sontag proposes that "it is in art that beauty as an idea, an eternal idea, is best embodied" (2002, p. 72). However, as Danto (2002) recognises, there is a difference between the 'idea' of beauty and the 'fact' of beauty. Beauty's place is not in the definition or -- to use the somewhat discredited idiom -- the essence of art, from which the avant-garde has
rightly removed it. That removal, however, was not merely the result of a conceptual but, as I shall argue, a political determination. And it is the residue of aesthetic politics that lingers on in the negativity we find in attitudes toward beauty in art today. (Danto, 2002, p. 39)

"Contemporary visual art stands on the ruins of beauty" claims the dustcover of Osborne's (2000) collection of essays, Where Theory Ends, There Art Begins. However, as Osborne points out, the question today is art's place in the "broader socio-historical processes and practices" and it is in this sphere that the "aesthetic" discussion falls (2000, p. 9). The art practices discussed in this research are firmly placed in contemporary social and cultural issues and, therefore, meet Osborne's parameters. They also take on board what Tousley (2001) refers to as a "revived interest in beauty" (see Chapter 2). Indeed, I have observed references to beauty appearing more frequently in current art writing.

When ArtReview International selected its top 25 of London's MA students for 2004, the reviewers were surprised by the resurgence of painting, and the emphasis on technique and drawing skills. According to Warren (2004), and his comments apply to all genres including video and installation:

a few years ago, 'beautiful' was a dirty word to students; now it's often something they aspire to. Their work doesn't have to be beautiful, of course – far from it, in some cases – but when it is, it's not to be sniffed at". (pp. 4-5)

Before proceeding, however, I wish to share Hickey's (1993) anecdote and his consequent discoveries. He relates that the reverie, into which he had drifted in the closing stages of a panel discussion, was interrupted by a question from the floor. The inquirer asked Hickey's 'opinion as to what 'The Issue of the Nineties' would be'. The reply sprang unbidden to his lips: "The issue of the nineties will be beauty", a response he states was "a total improvisatory goof". His "goof" was greeted with "total, uncomprehending silence", a circumstance that Hickey claims, for him, lent his "modest proposal ... immediate credence" (1993, p. 11). Inspired by his spontaneous declaration and its cool reception, Hickey embarked on an unofficial survey of "artists and students, critics and curators, in public and in private – just to see what they would say. The results were disturbingly consistent, and not at all what I would have liked", he writes.
Simply put, if you broached the issue of beauty in the American art world of 1988, you could not incite a conversation about rhetoric – or efficacy – or pleasure – or politics – or even Bellini. You ignited a conversation about the market. That, at the time, was the “signified” of beauty. If you said “beauty”, they would say, “The corruption of the market”. (Hickey, 1993, p. 13)

Hickey’s respondents’ reasoning was the presumption that art dealers “only care about how it [the art work] looks”, but that art professionals in institutions “really care about what it means” (1993, p.14). They inferred, pejoratively, that “Beauty sells” (p. 16). Hickey analyses the situation pertaining to the institutions, their growth, power and self-serving agendas, and suggests that none have a “vested interest in the subversive potential of visual pleasure” (p. 13). With Mapplethorpe’s images as a focus, Hickey argues that it is the beauty in the photographs that alienates the art establishment and, if the images had somehow acknowledged Mapplethorpe’s “corruption, and thus qualified him for our forgiveness”, the court action in Ohio, in 1990, would not have arisen. The Director of Cincinnati’s Contemporary Arts Center, Dennis Barrie, was arrested on obscenity charges in relation to seven images from Robert Mapplethorpe: The Perfect Moment. The images were later deemed by the court not to be obscene. Hickey concludes that “the vernacular of beauty, in its democratic appeal, remains a potent instrument for change in this civilization” (1993, p. 24).

The foregoing relates to the issue of pretty pictures of scientific or medical subject matter that are classified by several participants as illustration. However, the co-option of beauty in other forms of art work, such as biotechnologically based work that the collaborators regard as a ‘potent instrument for change’, appears to be an acceptable exercise.

There is beauty and elegance in scientific ideas, too, and Girod, Rau and Schepige (2003) conducted a pilot study to examine ways in which science teaching could foster an understanding of the aesthetic, not only in science, but to encourage students to link the aesthetic experience in science with their daily lives. The researchers found that their teaching programme significantly increased their students’ appreciation of aesthetic understanding, and broadened their vision of the world and their place in that world (Girod et al., 2003, p. 585). It thus seems ironic
that, at a time when research is establishing the value of art in cross-disciplinary functions, the merit in art education is being diminished in some sectors (see below).

The renewed interest in beauty could be cyclical. However, artists express their responses to world events in many ways, and an engagement with beauty could represent a reaction to the disturbing images of war and conflagration that currently appear in the mass media. In contrast, artists responded to the depression of the 1890s and World War I with radical work in the form of movements such as Surrealism, Dada and Cubism.

Functions of art

Kuhaupt thinks people hold a romantic idea about what art can do, but that sometimes art can be ahead of its time. In this sense he suggests that "art can almost predict public opinion in a way, rather than changing public opinion." For Williams (1965), "communication is the crux of art". The art work is a form of transmission of an experience which the audience can reject, accept, or ignore (Williams, 1965, p. 46). However, Wolpert (2002) concedes that art can "broaden our experience" in ways as yet not understood, but is adamant it "does not explain". Nicholls found the questions brought back to her historical reports of the role of art prior to the beginning of the twenty-first century. She recalls that, in the sixteenth and seventeenth centuries, art was not necessarily for entertainment or aesthetic pleasure, but was also a medium to convey messages about religion, personal aggrandisement, politics, and other topics. In addition to these purposes, art, as a function of society, was an indication that that society had enough wealth to allow a portion of that prosperity to be used for art. Here Nicholls emphasises that she is not discussing frivolous, decorative work. She invokes Maslow's Hierarchy of Needs wherein art comes further up the ladder than basic bodily needs and, for Nicholls, is an "indication that a society is more economically developed, more socially developed, and can afford to support art." For example, historians propose that prehistoric communities who decorated their clothing were experiencing times when food was more plentiful and life was more ordered. Nicholls challenges today's society to think about the different ways in which contemporary art is used and the audience it reaches. According to Bunt, it is the art galleries that attract many visitors to cities such as London or Paris, not the commercial houses, the factories or the
Nevertheless, controversial New York artist, Hans Haacke, contends that the increasing numbers of visitors to art museums do not signify a deeper interest in art but the entertainment value the institutions are providing (cited in D. Solomon, 2000). However, artists need to be part of the system to have a voice in public discourse, and Haacke continues to exhibit in the galleries.

**Art for art’s sake**

Although Castleden concedes that some artists may feel alienated and on the periphery of society, and that they use those sentiments in their work, disaccord and feelings of alienation do not have a role in her art practice. Rather, she engages with, and researches, art that critiques or pushes contemporary perceptions and boundaries.

Catts and Zurr describe a feeling of alienation as a sensation that the world does not correspond with the values instilled in people from childhood, and, in response to this, any noticeable “errors” should be identified and exposed. They also believe that art is an ideal tool with which to examine existing belief systems. However, for them, art for art’s sake is “formulaic”. They suggest that artists who work in this vein produce work that is irrelevant to the wider community. Art for art’s sake is “only ornamentation and decoration” which has its place, Catts reasons, but it is not created to stimulate profound thought on life or on our position in the world as it is today.

Clancy thinks that “the isolation from society that some artists feel is different from, say, the Marxist idea.” In a capitalist system time is money, there is a scale of payment for hours worked, but “an artist can spend fifty hours on an art work and it is not quantifiable.” Clancy sees this as a positive: “that is one of the brilliant things about art.” Nevertheless Clancy insists that “some art works are a part of the capitalist system in that they do sell as objects.” She reflects: “nobody is going to starve in terms of food if there is no art, but we would be poor through a lack of expression, and this would be tragic.”

Cleworth describes feelings of disaccord or alienation as elements that drive the initial creativity, but relates them to having very deep questions about one’s place in the world. Although he is passionate about art and art history, Benjamin is aware that some conceptual work that references its own self can become art about art, a
genre he does not find challenging. He regards art that emphasises the medium over the content as lacking in impact. For example, he explains that, despite Rembrandt’s incredible draughtsmanship, it is not that quality which haunts the viewer but the freedom of the artist’s engagement with the work and the essence that lingers therein, particularly in the late self-portraits. Piccinini and Castleden have similar views (see Chapters 8 and 11).

Meikle locates examples in science, rather than in art, to respond to the question regarding an art for art’s sake practice, and mentions instances “where a scientific hypothesis or an idea came about which was completely at odds with the conventional thinking of the day.” For example:

Galileo’s proposition that the earth revolved around the sun was thought to be heretical in that day, and was completely jarring and shocking compared with the philosophical framework at that time; Wegener’s concept of the movement of tectonic plates was radical as the earth’s crust was assumed to be a solid crust; and Einstein’s quote that God doesn’t play dice when he thought that it was completely non-scientific to propose a theory that you can’t know certain things. (Meikle)

McLachlan challenges the notion of art for art’s sake, because if art for art’s sake is where aspects of meaning and purpose are unnecessary, then that is just art, and art is non-utilitarian in purpose. Art could acquire utilitarian value subsequently but good art is not undertaken for utilitarian reasons. In the same way, McLachlan reasons that science undertaken for utilitarian purposes, rather than being driven by curiosity, is often less successful than generally supposed. Ever the storyteller, McLachlan recounts Nurse’s experience to illustrate his point that science for science’s sake is the best kind of science.

Nurse [now Sir Paul Nurse] was interested in cell division, a big problem in cancer. Although one school of thought believed that human cells should be studied in cancer research, Nurse opted to study cell division in the simplest possible organism, yeast. His reason was that it would be more proficient to do the initial study with the yeast, and then to do genetic work on it. He chose Schizosaccharomyces pombe, a South American yeast used for making a beer called Pombe, and which is an organism separated from humans by 2,000 years of evolution. His team discovered that the mechanisms which operate in the yeast are the same as the mechanisms which operate in
humans. It is brilliant science. Nurse won a Nobel Prize for his work. (McLachlan)

Therefore, McLachlan posits that:

... should always be for art's sake, and science should always be for science' sake, and utilitarian art and science actually delay you from getting there rather than helping you forward. So meaning and purpose, of course they should be unnecessary. Art and science should not be for a purpose. (McLachlan)

Benjamin agrees with Whitelaw’s (2000) views that, although new media artists have benefited from following the “technology juggernaut” and appropriating developments into their art practices, they would be well advised to concentrate attention on the content of their work rather than the category in which they operate (pp. 2-3). Benjamin’s concern for proponents of new media art is that they appear to struggle too much with the idea that they have the image or banner of a new medium to sustain.

Art as fashion, décor and entertainment

McLachlan and Clancy have both collaborated in varying degrees with artists linked to fashion. Storey’s Death Dresses, and the Barbican’s exhibition, Rapture: Art’s Seduction by Fashion since 1970, 2002, highlighted a connection between art and fashion. Smee’s (2002) review of Rapture suggests that, although the public is prepared to accept decadence in fashion, it is less likely to in art “where infatuation is so often regarded as trivial, and decadence is felt as a steep affliction” (p. 39). McDonald (2004) claims that “by degrees, art has become inextricably linked to ... fashion” (p. 4).

The National Gallery of Victoria billed its exhibition, 2004: Australian Culture Now, as “an unprecedented landmark national survey of work at the edge of current artistic practice” (Colless, 2004). Eleven curators presented work from 130 Australian artists, including representatives from craft, fashion, video, plasma screen installations, sculpture and many other fields. The art and the buildings are “so integrated” that one could describe the situation as art as décor, and décor “nuances our lifestyle” which, as Colless puts it,
could well be what will make 2004 one of the most exciting and formative shows of the decade. It demonstrates the ways in which artists are now freely disregarding the distinctions that once separated art from design, entertainment, leisure and commerce. (2004, p. R18)

Colless (2004) admits that, after reviewing the diverse segments of the exhibition in relation to aesthetics, multiculturalism and globalism, it is difficult to decide what work would fit the definition of "status of art", and, further, "what the word Australian means". He concludes that "after 2004 [the exhibition], maybe the phrase Australian art will become obsolete" (p. R19).

Nelson (2004) reviews 2004: Australian Culture Now as "a courageous exhibition" but recognises that the diversity of artists and art, which could be seen as a positive element, mediates against a cohesive common theme. He, too, comments that "some of the best work in the exhibition is the most handsome décor." For Anderson (2005), the exhibition highlighted the slippery nature of the current border between contemporary art practice and the world of commercial entertainment and leisure, but it also reveals the continuing ambivalence of many in the art world to the apparent collapse of clear distinctions between these areas. (P. Anderson, 2005, p. 90)

Respected international art magazines, too, have recently featured fashion as art, and art as décor and entertainment. Cleworth notes the blurring of boundaries between art and fashion in exhibitions and in the layout of journals and magazines that were previously classic art publications. He observes that current design layouts commodify art by advertising "art next to Timex: culture is another accessory". The integration of fashion with art in previously dedicated art publications is typical of the "laying of Modernism to rest, of moving beyond the theory of specialisation", according to Cleworth. This blurring of boundaries is symptomatic of the interdisciplinary mind-set that has made possible sci-art collaborations, and impacts on the art practices and role of most contemporary artists in one form or another.

Visual art education: Innovation and creativity

Although visual art education plays a part in the formulation of the attitudes of many visual artists, and some other community members, it was not specifically
targeted as a subject in the interview questions. Nevertheless, several participants brought it forward as an important issue for discussion. A visual art education is also linked by some commentators with creativity and innovation, the latter being an attribute the Australian Government wishes to promote (see Chapters 6, 7 and 8). Arnheim was cognisant of the role of the artist in relation to science, and the need for the education of the artist, in the 1960s (see Chapter 2). During the 1950s and 1960s, an internationally-based campaign was conducted in Australia to promote “education through art” (B. Smith, 1988, p. 51).

In Australia in the 1980s, as Nicholson (2000) explains, the Dawkins reforms led to many art schools becoming faculties of larger tertiary institutions, and, since the late 1980s, both Labor and Coalition governments have implemented funding cuts for education. “After Howard’s [Coalition] funding cuts, Australia became, with respect to education, the OECD’s lowest-spending nation” (p. 131). He adds that funding for visual art departments was affected in several ways: these included that, historically, the Australian Research Commission has regarded an exhibition as ineligible for research funding, but a journal article about the exhibition as eligible; and that private industry funding has not been forthcoming. In 1998, the Edith Cowan University introduced a Creative and Performing Arts Activity Index (CPAI), funded by the University, to reward staff for their creative and performing arts efforts that are not covered by the Australian Government's Research Activity Index scheme.

Nicholson reports that “the first term of the Howard government saw widespread closures of visual arts courses across Australian campuses”. The institutions that remained cut staff numbers: “sessional staffing was virtually eradicated, the result being a kind of institutional arthritis” (2000, pp. 131-132). I would point out that, as a result of the diminution of contracted staff numbers that Nicholson reports, some institutions found it necessary to increase the number of sessional staff employed.

The introduction of fee-paying courses, which Nicholson regards as a “contradiction between the impetus to practise art and the paradigm of economic rationalism”, was also promoted by government policy. Nevertheless, he reports that, at the Royal Melbourne Institute of Technology (RMIT), up-front fees did not “attract any significant interest in the art faculty” when they were introduced in 1998.
As Nicholson points out, “it is hard to imagine any bank manager leaping for his or her loan booklet at the economic proposition of a client paying [A$]30,000 to be trained as an artist” (2000, p. 133).

Recently, the Flinders University, in South Australia, has out-sourced its visual arts course to combine with the Adelaide Central School of Art, a private art school, to offer a five year full-time, or equivalent part-time, double degree – BA/Bachelor of Visual Art. In the mid-1990s, some university humanities departments in the USA also suffered funding cuts and were re-structured [see Steiner (1996), and Cordes and Walker (1996)].

Visual arts departments are also impacted upon by the emphasis on disciplines with a strong record in employment outcomes for graduates. Weller (2002) reports that the New South Wales Higher School Certificate (HSC) figures for 2001 reveal streaming into employment oriented courses begins in Years 11 and 12. Williams' deplores the situation in the UK where streaming between the sciences and the humanities in schools has led to a two cultures phenomenon and he proposes bringing the two "communities" together. Sixth formers do not have to be fully informed about quantum mechanics to debate the ethics and implications of the human genome project or stem cell research, Williams claims (cited in Radford, 2003, p. 9).

A MacArthur Fellow, Root-Bernstein's (1997) thesis is that “if we let the arts atrophy in this country [USA] through lack of public support, we also will lose an important part of the creative base from which the next generation of scientific and engineering breakthroughs will emerge". The Wellcome Trust (2004) reports that, in an interview, McLachlan claimed that evidence suggests that medical students with "some arts and humanities" background have a better outcome than many who have "focused on sciences". A third scientist, Doherty (1997), articulates similar concerns and believes that it is increasingly important that science students have a liberal education component in their degree. He sees advantages for parliamentarians and bureaucrats to have "an understanding of what science is about" and for scientists to have an understanding of "politics and economics" (Doherty, 1997).

As Janousek (2000) would have it, one ramification of the division between schooling in the humanities and schooling in science and mathematics manifests itself in the philosophy of western museums and galleries in relation to their lack of
integration of science and culture. He identifies that the “division of the education system... may have increased the efficiency of specialized training, but it also produced a deformation of natural character and reduced overall possibilities of communication” (p. 22). Some research participants observe that perceived difficulties with the appropriate communication of scientific discoveries are a concern. The ANU was sufficiently concerned to establish a Graduate Programme in Scientific Communication and describes science communication as “the processes by which the scientific culture and its knowledge become incorporated into the common culture”. However, the course outline does not mention artists specifically as among those the course planners suggest are expert science communicators.

The best science communicators include writers, journalists, TV and radio presenters and personalities, workers in science centres and museums, and communication officers for scientific, environmental and industrial establishments, professional associations and exhibition designers. (Australian National University, 2004)

Baker (2004) identifies the role of the art school as “generating cultural, intellectual, and creative capital in the broadest sense of the term... A good art school creates a milieu, an atmosphere, a critical context, an occasion for these explorations and opportunities ... a new conceptual marketplace” (p. 39).

Radok (2004b) cited anecdotal evidence of cuts in funding for visual arts education programmes to support her call for concerned artists to support the National Association for the Visual Art Limited’s (NAVA) programme of lobbying during the 2004 Federal parliamentary election campaign. She maintains that these cuts come in spite of the known benefits to employers of the capabilities of visual art graduates. Funding cuts to universities have necessitated rationalisation and encouraged the support of courses which provide commercially positive outcomes for students. Some universities have responded by merging departments, such as visual arts, under the Creative Industries banner, a term developed in 1997 by the Blair Government’s UK Creative Industries Taskforce. The Taskforce’s Creative Industries Mapping Document, November, 1998, defines creative industries as “those industries which have their origin in individual creativity, skill and talent and which have potential for wealth and job creation through the generation and exploitation of intellectual property” (cited in Cunningham, 2003).
The emphasis on an intellectual property rather than a material property outcome is a matter that Rossiter (2003) suggests needs attention. Cunningham and Hertley (2002) urge university humanities and arts departments to support the creative industries 'flag'. In a report prepared for the Australia Council, "Don't give up your day job", Throsby and Hollister (2002) recommend that community awareness of the cultural significance and contribution made by the arts be recognised "through the education sector and the media" (p. 80).

In her address to converge, 2002, in Adelaide, Rowley emphasised the partnership ethos of ARC in its funding of art and high technology because of three "key issues". One issue is the "very high international standing that Australian art and science/technology has", and another is the large amount of money artists will need, and the function of the Australia Council and the ARC in contributing research funds. However, it is her second issue I wish to emphasise here.

Second is your [the mainly artist audience's] understanding and emotional investment in research practice that "your idea makes sense to you". An example of that is the number of people who hold PhD's in this area, which is obviously not important in the arts industry [italics added] but it certainly is in the research community. (Rowley, 2002)

It would appear that, in Rowley's opinion, higher degrees are unnecessary in the arts industry. If this is the case, the question arises about future academic excellence in visual art teaching in Australia. In addition, if this area of scholarship is neglected, it may be that, as Kerr (Kerr, 2002) suggests, auction house catalogues could become a prominent source of art historical data.

Buckley and Conomos (2004) posit a case for the traditional contemporary artist that parallels the discussion about the influences of funding in Chapter 5.

As well as the obvious disadvantage that individual artists face through not having their creative work funded, a manipulative climate has grown up in which they are encouraged to develop research projects that do not represent their primary intellectual concerns as artists but do fit neatly into the ARC funding categories. (Buckley & Conomos, 2004, p. 40)

A similar debate occurred in the mid-1990s. Hill (1995a) presses a case for the research and expertise accumulated during an artist’s successful national and
international career, that fulfills an agreed set of criteria, to be recognized by academia. His proposals include formats for university degrees on several levels that incorporate course work with an accompanying exegesis. He notes the irony that artists, who were prime movers during the Renaissance and Enlightenment, are the late-comers to university campuses (p. 12). Hill (1995b) advocates that eligible art lecturers employed in universities pursue applications through the ARC Grants Scheme to avail themselves of the opportunities offered and to reinforce the validity of research and practice in the visual arts (pp. 26-27). “In the near future”, according to Radok (2004a), Ascott’s Planetary Collegium plans to establish a PhD programme, “dealing with the burgeoning field of consciousness issues”, in Adelaide, South Australia. The candidates would be based in Adelaide but registered as PhD students with the University of Plymouth, UK.

Lee (1996) delivers a riposte to Hill’s article. Lee argues that university visual arts departments are taking over the role previously exercised by Technical and Further Education (TAFE) and private art schools. He disparages the staff selection processes, questions the ethics of educating students for low-paid or non-existent jobs, and reminds his readers that the visual arts courses at universities are sustained by the high demand for places “rather than by evidence of outcomes”. Lee cites reports by Throsby and Thompson, 1995, and Prosser, 1995, for the Australia Council to support his argument (1996, p. 5). Geczy (2002b) paints a damming picture of the parlous state of art education in Australia and asks whether art schools are, indeed, necessary. Lee (1996) argues against the awarding of higher degrees in the visual arts, and is sceptical of the validity of an exegesis to accompany art work. It is his understanding that artists find it difficult to explain what they intend before they create the work, and that it is impossible to translate paintings into words. Lee claims that artists have no uniquely privileged understanding of their work [italics added] (p. 4).

Lee’s views re-emerge in a report on The Art of Seeing and the Seeing of Art, a conference held at the Australian National University (ANU), in 2001, for the Newsletter of the Adelaide Central School of Art (ACSA), distributed more widely by Amy Ione, with permission. Lee questions the attitude of some higher degree art students who opt to isolate themselves in their studios instead of taking advantage of the opportunities around them. He asserts that, by isolating themselves, they fail to
inform themselves, not only about the science and art area, but also about the wider world and the benefits that interdisciplinary associations can provide.

What ultimately can they hope to achieve isolated in their studios, and why should a wider public seek out such work when it is finished? By turning away from the ethos of university research, artists are confirming their position as mere suppliants, with ambition that aims no higher than to win approval from the unaccountable processes of art world valuation. (Lee, 2001)

Costache (2002) identifies visual literacy as an issue. At a time when the image reigns, and the screen is the dominant means for the dispersal of news and information, textual literacy across disciplines is emphasised but visual literacy, or “seeing”, is neglected. As Costache argues: “a picture may be worth a thousand words but do students have the tools to find those words and further decipher their meanings?” (2002).

The Australia Council (2003) promotes education in the arts and claims its “strategy highlights the catalytic role the arts can and do play in the social, personal and intellectual development of young Australians”. In 2002-2003, the Council funded seven research projects, one of which was designed to examine “the value of links between education and the creative arts, particularly for children and young people at risk of not completing formal education or training” (Australia Council, 2003, p. 31). Root-Bernstein (2003) claims that art classes should be required for all scientists as well as children, as they help to develop “attention and accuracy” (p. 271).

To invent and to create requires an understanding that incorporates all that is known sensually and abstractly, subjectively and objectively, imaginatively and concretely. And because of their wide disciplinary training in the imaginative skills, handicrafts and expressive languages, only polymaths will have the tools necessary to do so. Thus, the future of innovation will reside, as it always has resided, in the minds of multiply talented people who transcend disciplinary boundaries and methods..., science is both the past and future of innovation because innovators cannot help drawing upon any form of thinking that will spur their imagination. We ignore this profound truth at our peril. (Root-Bernstein, 2003, p. 276)

Cleworth detects another element appearing in the art education system that derives from the amalgamation of art schools with universities. He claims that, as
new additions to the organisation, the art schools are required to change to fit the academic model of assessment and grading, and that this has led to an institutionalisation of the intellectual approach to art education and art practices. This modified approach has been necessary to allow the people already within the system to understand the visual arts, but has forced visual art lecturers to change the way they teach, and students to change the way they study and approach their art, to comply with curriculum requirements. Cleworth says it “will be interesting to see how this amalgamation of visual art into the academic system plays itself out within the art world generally, both in Australia and internationally.”

In his pursuit of higher education, Cleworth was advised that a Doctor of Philosophy is regarded more highly than a Doctor of Creative Arts or similar new degree with an art coursework component, and that a Masters by research is regarded more highly than a Masters with an art coursework component (R. Cleworth, personal communication, November 2004). On closer analysis of the inferred hierarchical differentiation between the two streams of higher degrees, it could be argued that it is the desired outcome and preferred career path of the candidate which decides the more advantageous pathway for the particular set of circumstances. For example, on one hand, a scientist seeking a collaborative artist for a sci-art project would, in all likelihood, prefer an artist with greater ‘hands-on’ art technical expertise than one who specialises in art theory and history. On the other hand, a scientist seeking a collaborative artist to provide an art theoretical and historical context for a theoretical research project could prefer an artist with research oriented skills. These hypothetical scenarios highlight the need to transcend dichotomies and dualistic modes of thinking, as claimed by Bois (1997) and Kemmis and McTaggart (2000), to reach a third position where interdisciplinary and multi-disciplinary qualifications are valued for their relevance to the candidate’s desired outcome.

In addition, Cleworth observes that the tertiary academic requirements impact on students who are not articulate although they may be artistically talented. The fortunate students are those who are gifted both academically and creatively. Unfortunately, students who struggle to articulate their ideas are those who are more inclined to experience a lack of confidence and possibly “drop out”. In Cleworth’s experience, the former specialised art school did not grade students using strict academic guidelines or “impose a preconceived set of ideals about what good
artists should have at their disposal”. Provision was made for both those who wished to develop their critical articulation of ideas and those who wished “to develop those skills that were relevant to them and their art practice.” Here Cleworth senses a correspondence with the academies of the nineteenth century and suggests that the institutionalised system will “produce a lot of art that at the time is going to make some artists very famous and very wealthy”, but he proposes that “we are going through a period where perhaps some of the really interesting work is happening by artists who have chosen to work outside the system – outside those commercial and cultural pressures.”

While most people, Cleworth contends, recognise that the Venice Biennale (Australian selection) and the Australia Council are, by nature, influenced to a degree by politically aligned judgements, a situation he acknowledges is probably a necessary and unavoidable part of that aspect of the art world, he would prefer that this attitude did not permeate visual art education. He foresees that if university art departments adopt a similarly narrow focus, students will be “formulated, in some cases from quite a young age, to certain methods of thinking. This comes back to a highly academic way of working which does not necessarily create lateral and creative thinking.”

Cleworth might draw some comfort from Bott’s” address, titled The Arts and Education, delivered in August, 2004. Her focus was the vital part the visual arts play in a well-rounded education. She spoke of the Australia Council’s National Education and the Arts Network and the research projects it is undertaking. An international summit is convened for late 2005 in Sydney, Australia.

The Council knows that the way to ensure that Australia’s future can benefit from integrated creative learning, is to bridge the gaps between our creative arts industries and our education system. New and strengthened partnerships between schools, universities, other educational institutions and individual artists and arts companies are vital to fully backing Australia’s ability. (Bott, 2004)

Bunt indicates that the establishment of art departments within universities has facilitated greater interaction between science and art. He suggests that, although the artists are highly likely to continue working in their chosen medium, they are now in a position to approach another university department with a proposed interdisciplinary project. For example, a textile lecturer could visit the engineering
department, or the biology department, and ask about the possibilities of "growing clothes" or developing "clothes with inbuilt circuitry". Bunt claims that this type of engagement can be beneficial to all concerned. Fisher" (2004) reports on ideas at a recent presentation: "In the world of Biomimicry, a possibility for the future is clothes resembling cells so as the child grows, so do the clothes ... something new and interesting to ponder" (pp. 5-6).

As a further means to foster interdisciplinary engagement, in 2002, SymbioticA commenced a VivoArt course for undergraduate students from various disciplines at UWA during which they experience a practicum in the wet laboratory. However, a few practising artists who have participated as artist in residence at SymbioticA have preferred to visit the laboratory as an onlooker and then to return to their art studio to work. In these cases, their art has developed a biological overtone but it is not looked upon as quintessentially bio-art, and its essential premise is not the critique of science. There have also been instances where artists have approached SymbioticA but have been deterred by the exigencies of producing art within the wet laboratory.

Asked whether he considered artists were appropriately educated to deal with general scientific issues, Long contends that this is the reason it is necessary to have a collaboration between a scientist and an artist. He mentions that, in some instances, an artist or a writer will research a scientific subject very, very well and convey an accurate depiction, but this is not always the case. As an example, Long discusses the close interaction which is necessary between him and the artists who work with him on palaeontologic projects, and the need for the artists to work from primary information to achieve accuracy.

Bernard Smith (1988), the doyen of Australian art historians, locates a division between the professional training of artists and the art teacher training systems. He suggests that one of the influences to sustain that division is a "faculty psychology: the notion that certain subjects in the curriculum are better suited than others to inculcate certain skills in general and certain faculties or powers of mind" (p. 54). Although Smith's text was published in 1988, his idea retains its validity. His solution is that "those who have enjoyed a full professional training in the arts and crafts are also those who are the best equipped to teach it" (p. 53), and he proposes a system of "community workshops", possibly attached to universities and schools,
where arts practitioners could be trained in all aspects of a professional practice (1988, pp. 54-62). Smith denounces the division between artists and crafts persons, as does Timms. “The Visual Arts/Craft Board [of the Australia Council] points out that it has nothing against what it calls traditional crafts practice, it simply doesn’t fund it” (Timms, 2004b, pp. 129-130).

Wilson (2002) hypothesises that a reliance on traditional forms of scientific and technologic research could delay progress and that potentially unexpected results could be precipitated by input from artists with the relevant education. “The arts could well serve an important function of independent vision if artists were prepared to learn the knowledge, language, work styles, self-discipline, and information networks that are instrumental in their fields of interest” (Wilson, 2002, p. 39).

Kupka, an artist with links to science who practised in Paris between 1911 and 1914, is known to have been well informed in many subjects including contemporary scientific developments and ‘eastern’ mysticism — the quintessential polymath. Kupka is discussed further in Chapter 11.

The “classroom” in 2099 will be equipped with multidimensional holograms and a polymath teacher, if we accept Chandler’s” (1999) prognostications. She urges educators to act now to re-examine the ways in which art and science are taught, and to encourage collaborations before students reach tertiary level so that future generations will be suitably equipped to use advanced technologies constructively. From her research, Chandler is assured that “science and art share common turf much like visual artists conceive of positive-negative space and the edges they share”.

In listening to and observing scientists and artists who are innovators in their studios and laboratories, the clarity of the interrelationship between artists and scientists is apparent. They are always slipping through magic mirrors of experimental procedure or falling down rabbit holes of theory. (Chandler, 1999)

An advocate of the polymath, Root-Bernstein (2003) suggests that, because scientists have profited from artistic insights, a claim he substantiates with considerable research examples, a reassessment of transdisciplinary interactions and their impact on innovation would be appropriate. He argues that an education in the arts aids the careers of successful scientists and that “there exist fundamental
connections between sciences and arts that provide non-trivial windows onto the gardens of the mind where innovative thinking is cultivated" (Root-Bernstein, 2003, p. 268).

**Role of gallery management, dealers, auction houses and collectors**

Although public and private institutions and corporations have the capacity to impact on the role of many artists, some participants also attribute a measure of power to gallery management, dealers, auction houses and collectors as they are frequently the artist's public representatives in business and entrepreneurial matters, and the arbiters of which work will be given gallery space. According to Kirby (1999), art critics and historians perceive the following as those who decide what constitutes "art":

in institutional recognition by art dealers, commercial and state galleries, art bureaucrats, artists, critics, art historians and publishers. But what is relevant, what counts as art is negotiable. The art canon, like capitalism, continually grows, creating new markets, absorbing and legitimating attempts to subvert it. (Kirby, 1999, p. 151)

Robert Cook, Associate Curator of Contemporary Art at the Art Gallery of Western Australia, exhorts artists to work outside the limited commercial gallery system, to exhibit wherever they will, in an endeavour to put their work before the public (R. Cook, personal communication, August 28, 2004). However, Smith (1988) attributes much of the growth in the wider public interest in art in Australia in the 1960s to the energy of private gallery owners and commercial art dealers who educated sections of the public who could afford to purchase art (p. 51). Purvis (2002) is cognisant of the difficulties for gallery owners who are presented with often challenging art work that unsettles current thinking, and for which they are required to find a market, preferably as quickly as possible, to enable the artist to keep on working. Nevertheless, Reid (2002d) is not totally sympathetic to the art market, and argues that a lack of industry accreditation allows people with no depth of experience to call themselves art consultants or dealers.

It's a huge problem. There's a lot of unethical behaviour; the art world gets away with behaviour that would put people in jail in the financial markets. Things like insider trading, all those kind of concepts just don't exist. Hidden commissions, golden handshakes, backdoor deals,
it can be quite murky. It's absolutely "buyer beware" and I say to people, "Make sure you're dealing with the right people". (Reid, 2002d)

Galleries that have censored exhibitions include the New York Guggenheim Museum, which withdrew art work by Haacke in the 1970s because it [allegedly] questioned the propriety of the business dealings of a prominent citizen. The Guggenheim management's actions prompted other institutions to be wary of the artist. In 2000, another furor erupted over Haacke's installation, *Sanitation*, for the Whitney Biennial. *Sanitation* linked the controversy, in 2000, over the First Amendment (associated with the *Sensation* exhibition at the Brooklyn Museum of Art) with the suppression of free speech in Nazi Germany. To assure the public that the Whitney Museum would not "deliberately" trivialise the holocaust, the Director, Maxwell L. Anderson (2000), stated that

Mr Haacke was put forward in April 1999 as an artist for the Biennial based on his reputation as a very influential artist.... That was five months before the "Sensation" exhibition opened at the Brooklyn Museum of Art. Once he decided to change his work to focus on the controversies swirling in Brooklyn, we faced the alternatives of disinviting him from the exhibition, which would be tantamount to censorship, or to proceed with the work and seek to explain his intentions. We chose the latter course, mindful that it would cause a great deal of concern.... While their personal feelings about the work may differ, as a Board they supported me in the Whitney's obligation to protect freedom of expression.... Deeply disturbing though it is to recall the excesses of the Nazis in order to draw a parallel to contemporary intolerance in the United States, it is the artist's right to do so, and the Whitney will support his right to express his opinions in our galleries. (M. L. Anderson, 2000)

The role of auction houses, and their impact on art practices, has significantly increased over recent years. This growing influence has not escaped the notice of Kerr (2002), who observes that the catalogues produced by auction houses have become significant contributors to the knowledge-base of Australian art in the face of an inadequate art history milieu (p. 76). Clearly, rigorous research and documentation of art work, and the wider publication of that information, could assist to overcome an unscrupulous practice Reid (2002d) describes wherein art works are renamed to hide details of their provenance and to enable the dealer to inflate the price. This practice of changing titles, Reid says,
is very, very dangerous, because it makes the collector unable to check and double check, and trace, and ultimately it makes it very difficult for academics in years to come, to follow through and research paintings. Very dangerous, very unscrupulous. (Reid, 2002d)

The ABCTV's Reality Bites: Art House: The thrill of the chase, screened in August/September 2004, follows the events in Australian auction houses as the auction season approaches. The documentary emphasised the importance of the catalogues to sellers, to prospective purchasers and to artists as their works reach the secondary market, both in boosting financial returns and in authenticating the provenance of the offerings. Manipulation of the market is not unknown, and artists' careers can be impacted upon by a contrived meteoric rise followed by a corresponding plummet in the prices for their work at auction. Another concern here is that, should the art economy and auction balloon burst, auction catalogue research would be diminished. In relation to concerns about other forms of art research, Kerr refers to the abandonment of the sequel to the Dictionary of Australian Artists ... to 1870 (1992) which she attributes to the short-term research funding regime that currently prevails. "In 2000, the new Director of the Australian National University Centre for Cross-Cultural Research closed down the Dictionary project, despite [it] being a foundation core project of this ARC-funded Special Research Centre" (Kerr, 2002, p. 77). An increase in the number of research academics in the visual arts could help to address this concern by strengthening the voice for improved funding in art historical studies.

Collectors also play a part in an artist's career path. The exhibition of work from Australian art patron, Steve Vizard's, extensive private collection in Melbourne, in 2003, was accompanied by a catalogue containing academic essays written with the general public in mind. Although Vizard has curatorial advice when making purchases, he expects contemporary art to be challenging and confronting, and admits that he finds understanding what is happening in an artist's 'head-space' a problematic exercise (cited in Crawford, 2003, pp. 63-64).

Many prospective collectors regard the comments of art critics as indicators of the directions of some art practices and the wisdom of collecting certain artists. Blond, the art critic for Western Australia's daily newspaper, the West Australian, admits that, ultimately, subjectivity is the ground upon which he decides the exhibitions he will review (S. Blond, personal communication, August 28, 2004). In
a few years the problem of subjectivity in artistic evaluation could be solved, suggests Bezruczko (2004). He explains the credentials of developments in testing for artistic judgment which he claims will help to guide students in their choice of study programmes. "The fact that virtually all human expression is mediated by artistic judgment now presents an even more challenging goal – design of programs in schools and communities to enhance and develop artistic judgment" (Bezruczko, 2004, p. 188).

A perception of subjectivity as a strong element in art practice, as well as art criticism, stimulates speculation regarding the contribution art can make not only to an art and science interaction, but also to wider discourse. Hanrahan" (2000) argues that it was in the 1860s that assumptions of art's "capricious subjectivity" and science's "cold objectivity" gained authority (p. 267). Since the 1950s, such delineations have been widely discredited but, as Hanrahan observes, they still persist in some quarters. In an analysis of the processes involved in the creation of two of her sculptures, Responsibility, 1993-1994, and Translating Movement, 1995, Hanrahan scrutinises the elements of objectivity and subjectivity in contemporary art practice. She demonstrates that the processes whereby artists clearly state the questions arising from their chosen subject matter, and critically examine their solutions to the ensuing problems, are not performed sequentially, but are concurrent. Therefore, subjective and objective orientations are required as the art work is progressed. "Thus, art-making seems to share some cognitive tools with critical modes of inquiry such as science, particularly if 'one focuses not on the works but on the process by which the works are conceived'" (Hanrahan, 2000, p. 402).

Delgado’s doctoral thesis, accepted in 2001, suggests that analogy emerges as “a form of knowledge present” in both art and science. Several aspects are identified that Delgado claims point to the wisdom of encouraging interdisciplinary study. The dissertation’s general conclusion reads:

We propose not to separate objectivity and subjectivity, reason and intuition into the respective realms of art and science. On the whole, we consider that it is necessary to eliminate the false hierarchy between disciplines and opt for interdisciplinarity. Analogy is the system of relations that describes knowledge, the principle and method that makes unity and diversity possible, and the continuation of human expression through the forms of art and science. (Delgado, 2004, p. 402)
Responses to quote from Christopher Allen

"The best art says things that cannot yet be put into words".  
(Allen, 1997, p.12)

The last research question invites the interviewees to respond to the above quote if they wish. I anticipated that its openness to interpretation would provide the participants with an opportunity to express, in a less structured and more relaxed way, any wider views that they had not seen fit to offer previously during the interview. The responses were varied and, although most participants treated the quote as philosophical, in a few cases it was taken as an opportunity to discuss further the use of text to accompany sci-art installations.

As a traditional painter, Benjamin feels that his ultimate aim is to achieve a state in his work whereby it reflects Alien’s observation, a response consistent with his attitude to his art practice outlined previously. Another painter, Cleworth also agrees with the sentiments in the quote and adds that he surmises that cutting edge scientific and mathematical research deals in a similar way with concepts that initially are not fully understood. He portrays the process as one in which the researcher has a “deep intuition” concerning a concept, “an initial gut reaction”, then, through a long process of gradually trying to understand that intuition through time and work, understanding might come. Nevertheless, he cautions that “artists might not even understand, or be able to intellectualise or conceptualise fully, that intuition during their lifetime”. In a similar vein, Berger writes:

While it is true that a work of art is a homogeneous, indivisible and (strictly speaking) unanalysable whole, it is false to pretend that it can be grasped instantaneously in all its complexity. Intuition allows us to understand it in part, or more exactly, brings us into contact with it, but it is reflection orientated by intuition, and intuition guided by reflection, that lead gradually to knowledge. (R. Berger, 1963, p.114)

Cleworth’s suggestion that Alien’s quote could also refer to cutting edge scientific and mathematical research is supported by Meikle, who provides a helpful insight by pointing out that when he read the quote it occurred to him that:

There is a parallel in the scientific world as well. Often the things that are most important and make the biggest breakthroughs in science are the things that answer questions
that people didn’t even realise were questions at the time. This often happens. (Meikle)

This insight corresponds with notions of the ‘discards’ or the ‘things in-between’ which are more fully explored in Chapter 11.

Castleden is sympathetic to Alien’s notion and considers it a great quality in art. Indeed, Castleden expands the concept beyond art to encompass instances such as “to explain how birds flew over your head is perhaps not nearly as good as experiencing the birds flying over your head, or, perhaps, a moment in a movie where there is just a poignant space between something else”. Nicholls says that the quote encapsulates her interactions with the art in the Guggenheim Bilbao Museum and other events described during her interview, and she emphasises that, for her, the response to art “relates back to it being about feelings”.

“The best art says the best things that cannot yet be put into words” declares Clancy, which raises the issue of quality. Apart from this digression, Clancy responds that Alien’s quote is “amazing” and conveys her way of thinking about art, which is that art can communicate an essence that hasn’t quite come to the surface, an essence that someone has not been able to communicate successfully verbally. Along with Clancy, Kuhaupt agrees with the quote “in a way”, but questions how one defines the “best art”, and proposes that the quote “suggests a romantic notion that art expresses the pure thought or emotion beyond the limits of language.”

Another change of emphasis is proposed by McLachlan who asks “What is this “yet”? That implies that it will be ‘putable’ into words. That’s a very interesting idea.”

The worrying thing is that there are some things which cannot be put into concepts and, therefore, can only be described, for instance, mathematically; and you can never have any conceptual understanding of what you mean. For example, we have particle duality, the way an electron is both a particle and a wave. We have no concept for that. (McLachlan)

McLachlan suggests that we think by analogy to assist in the understanding of ideas to which we cannot ascribe any meaning, but “if there is nothing in our
analogy sets, nothing in the toy box to match it to, then it is hard to have a mental concept of it”. McLachlan’s observation reflects my experience and that of many visual artists with whom I have spoken who strive to translate difficult concepts into mental visualisations. McLachlan recites excerpts from Keats’ *On First Looking into Chapman’s Homer*, which he regards as “a brilliant poem” because:

> it is analogous, like “a new plant swims into his ken”, so he makes a set of analogies very explicitly in trying to describe how he feels about the poem, and I think that that is really interesting. He has no language for how he feels about the poem except by making comparisons with other things. (McLachlan)

> “Art can say things that can never be put into words, and that is one of its values” emphasises McLachlan. He points out that putting things into words with a limited toy box poses problems but art, with its:

> more fluid nature, changes chimeras spontaneously and changes without having to go through a conscious process of change, whereas once something is written, it is written and you have to score it out, you have to write something new. So putting things into words formalises, ties down and defines, and that is not how I feel about art. (McLachlan)

In relation to science communication, Edmondston appraises the quote in relation to her proposed sci-art project and advances the notion that the work will “perhaps reach people who would not see the written word, or the spoken word, but who maybe will respond to a visual representation”. Bunt also responds in the didactic vein and discusses the quote in relation to the necessity or otherwise for explanatory information to accompany sci-art exhibitions. His comments are reported in the discussion of curatorial paradigms for biologically based art exhibits (see Chapter 5).

> “That’s a good quote”, Long responds. He interprets it as drawing on “the classic distinction between art and science” – science as “something definable, logical, rigid, and containable” in contrast to art which is “emotional, classic, a response from the heart”.

The views of these artists are, in part, summarised by Ball and Keating (2002) who propose that:
art does have the capacity to heal, to question, to challenge, to connect, to celebrate, to empower, to reflect and indeed to be an agent for beneficial social change. It also allows us to imagine a different world and a way of getting there. (2002, p. 44)

Summary

In this chapter, the participants raise a variety of contexts applicable to contemporary 'traditional' and new media art. These include their experience of the functions and characteristics of art in contemporary society and culture; their sense of what art means; and their attitude towards interdisciplinary educational opportunities, particularly at a tertiary level. This summary analyses the dialectical processes observed within and between the participants’ experiences and perceptions.

The participants recognize art as an agency for critiquing and understanding the world around us, and that it achieves something that cannot be put into words, but which encourages us to see differently. Their position accords with the theories of Alvesson and Sköllberg (2000) who argue that a dialectical tension between realised and alternative ideas and interpretations enables one to see the world differently and decisively. Although Kuhaupt suggests that art can sometimes predict rather than change public opinion, Fisher claims that art permits one “to recognise and change the world” (cited in M. Solomon, 1973, p. 270). Other participants suggest that art is a useful means of examining existing belief systems, and of presenting concepts that have not been seen before. Although Wolpert (2002) accepts that art can offer ways to new experiences beyond our present understanding, as Laib maintains, he is clear that art does not explain. In relation to its background and context, some participants suggest that art can be novel, can offer a solution to a problem, and can challenge. These movements between multiple layers of understanding are typical of Greeng’s (2000) hypothesis, referred to in Chapter 1, whereby he asserts that an awareness of numerous viewpoints and an appreciation of context facilitate dialectical processes.

Time, stillness, and other elements that are ‘proper’ to the art work, as René Berger (1963) expresses it, all contribute to the appreciation of, and interaction with, works of art. However, these factors also aid the cultivation of other intangible qualities in art that the participants mention, such as notions of the muse, mystery,
magie and transcendence. The 'transcendent' relationship Briskman (1985) describes could be regarded as an example of a triadic dialectical process, described in Chapters 1 and 2, as the artist moves from a former mode of practice via an inspirational interaction to a different level of art practice.

The relevance of many of the attributes the participants ascribe to art is contested by some proponents of new media, and Wilson asserts that a clear definition of art and an art masterpiece, and the criteria for their evaluation, remains elusive. That aside, a tension exists between Wilson's assertion that new criteria need to be established, the promotion of Wilson's book as "the Bible" for new media artists by Catts and Zurr (see Chapter 11), and the inclination by some sci-artists and new media artists to appropriate existing art paradigms to provide a curatorial framework in which to present their work. In addition, new media proponents suggest that the long anticipated 'death' of art and its aura has now arrived, supplanted by new media which are seen by some as superior because they are more 'up-to-date'. As stated in Chapter 1, Jervis (1998) maintains that patterns of recurring tensions, such as the cyclical claims of the imminent 'death' of art, represent a framework for interpretation of data. In this instance, I suggest this pattern underscores the dialectical processes of strains, tensions and possibilities occurring in the call by proponents of new media for a new approach to the definition of art and its evaluation. It appears to me that, although they wish to change the notions surrounding conventional art, they also wish to appropriate some of those notions to form curatorial paradigms for new media. The responses to their call are still awaited.

Wilson (2002) advocates that artists need to learn, among other skills, self-discipline if they are to function within scientific and technological research fields. Although he advocates new ways in which artists can practice, Wilson appears to adhere to the myth that all artists are unreliable. This myth is arguably countered by the relations of production of art in the early twenty-first century, where artists face keen competition for recognition, and require dedication, self-motivation and self-discipline to maintain a professional practice.

In addition, the claim that art can challenge and prompt debate, a situation on which sci-artists base much of the raison d'être for their work, is contradicted by Wolpert (2002) who claims that there is no critical thinking in art. This conflict of
ideas suggests that the dichotomies will need to be transcended to achieve a "more comprehensive perspective" (Kemmis & McTaggart, 2000, p. 575).

Beauty is an unanticipated but relevant topic to emerge from the interviews. The euphemism 'interesting' has been used instead of beauty for some decades, but, since the late 1990s, beauty appears to have been reinstated. Participants make it clear that it is not 'eye candy', naïve or decorative beauty to which they refer, and some commentators attribute the resurgence of beauty in art to the influence of the art market and art dealers. Although an evaluation of beauty in art could be seen as subjective, some sci-art exhibits, such as Pig Wings, are designed with careful regard for aesthetics, such as colour, form and presentation. The renewed interest in beauty could be cyclical, but the movement for beauty seems to parallel the increase in images of the ugliness of war and civil strife that haunt the world media. It may well be, as Hickey (1993, p. 24) argues, that "the vernacular of beauty ... is a potent instrument for change", although it is worth noting that the significant changes in the visual arts that occurred after the depression during the 1890s and World War 1 were not necessarily related to beauty but to radical forms of art, such as Surrealism, Dada and Cubism. The grounds for the contemporary rehabilitation of beauty could provide an area for further research but additional subjects are beyond the scope of this study.

Although some participants are aware that difficult world situations could encourage attitudes of alienation, they have little sympathy for artists who choose estrangement for selfish reasons. The resulting art work is usually irrelevant and utilitarian, they claim. The term utilitarian is also used to describe art's sake. Some of the participants view art for art's sake with scepticism, and, although Question 10 gives Plekhanov's definition of art for art's sake as "wherein aspects of meaning and purpose are unnecessary", in some instances participants appear to interpret his premise differently. Art about art, and art that emphasises the medium over the content, are not regarded as engaging or challenging by many of the participants. This situation also pertains with new media where, in some cases, a greater concentration on content over category is recommended. In other words, categorising art may contain it, rather than enabling opportunities for creativity. It is thus ironic that new media and sci-art, such as Kac's Alba, which could be seen as appropriating the products and techniques of scientific research and technological
advances as one participant points out, does not generate or invent new models or materials. However, new media or sci-art are frequently hailed as 'cutting edge'. An artist's move to create a synthesis from the conflict between form and content, and thus develop a new level of work, would satisfy Magee's (1998, p. 159) notion of a three stage dialectical process that constitutes a pattern of change. Two participants report outcomes in science that illustrate this notion.

Meiklo points to scientific hypotheses that were undertaken as science for science's sake, and without a utilitarian purpose, that challenged the conventional thinking of the day, and the results of which brought about radical changes in scientific knowledge. McLachlan agrees that science driven by curiosity is often more successful than science undertaken for utilitarian purposes, and he asserts that 'good' art is not undertaken for a utilitarian purpose. Indeed, McLachlan is clear that art and science should not be for a utilitarian purpose. A utilitarian purpose frequently precludes experimentation and innovation, a circumstance which limits the opportunities for an 'aha' moment, or Briskman's (1985) transcendent experience.

Fashion may not be accepted as utilitarian, but, along with décor and entertainment, it has recently been linked to art in exhibitions, journals, and magazines. As Bunt points out, it is the art galleries, not business premises, that tourists seek out, but others query whether it is the art or the entertainment package in which it is now frequently presented, that attracts visitors. This linkage of art with entertainment is viewed as typical of the postmodern blurring of boundaries, and another expression of the interdisciplinary era which has facilitated the development of collaborative sci-art practices. In addition, the movement of art, by some entrepreneurs, into the arenas of fashion and entertainment demonstrates Bukharin's (1973) idea where the "dynamic equilibrium" of the social situation, such as where art and fashion co-existed as distinct entities, is "disrupted and then restored" (p. 201). The 'restoration', or the possibility of same, is an unknown quantity at this time.

Some participants express interest in the current system of visual art education and its projected role in encouraging innovation and creativity. They judge the curtailment and, in some cases, the closure of tertiary visual art departments due to economic rationalism to be a retrograde step, and base their opinions on arguments
that a visual arts education in interdisciplinary contexts enhances the ability of all students to ‘see’. The skill to ‘see’, rather than to simply ‘look’, has relevance in disciplines other than visual art, such as science, medicine and mathematics. For instance, Costache (2002) regards it as unfortunate that, at a time when visual images inundate most aspects of current daily life, textual literacy is encouraged and visual literacy is neglected.

The research indicates that tertiary art education is undergoing change and that the tensions between the funding constraints of the universities, the advocacy for new forms of creativity and innovation, and the students’ desired outcomes are creating an undercurrent of concern on a number of levels. The constructive resolution of these conflicting “underlying aspects of the phenomenon”, as Boyatzis (1998, p. 16) describes them, could provide the impetus for a new form of art education, perhaps one predicated on contemporary adaptations of the notions of Smith (1988) and Cleworth.

Cleworth hypothesises that perhaps art schools that remain outside the tertiary academic system permit students more freedom to explore avenues of lateral and creative thinking. In this case, possibly the teachers would be artists with a full professional training, as Smith (1988, p. 53) advocates. Cleworth observes that, currently, artists working outside the system are producing some really interesting work. Conversely, Bunt points out that those visual art students who are located in universities today have an opportunity for greater interaction with other disciplines, and, in some instances, have access to facilities such as SymbioticA which encourage interdisciplinary collaboration. These conflicting points of view highlight the strains and tensions that exist between stakeholders in the visual art education area. These stakeholders include the students, the institutions, the government, and other parties who employ, interact or collaborate with the visual art graduates.

Commentators disagree about the value of higher degrees within the visual arts, and higher degrees with an art or exhibition component are regarded cautiously in some academic quarters. Attitudes, such as Lee’s (1996), that would limit the opportunities for visual artists to expand their expertise and knowledge by attaining higher degrees, could impact adversely on the quality of visual art lecturing in the future.
Cross-disciplinary knowledge and expertise play a significant role in the development of the polymath, according to research into the vocations and avocations of successful scientists, such as Nobel Laureates. Doherty (1997), a Nobel Laureate, suggests that the benefits of an interdisciplinary approach extend to the broader community. As an example, the broader community is disadvantaged if, as proposed by some participants, a lack of cross-disciplinary interaction between the humanities, science and mathematics has affected the philosophy of western museums and galleries where, in some instances, science and culture are frequently regarded as two distinct entities. Some participants also link over-specialised training with a perceived reduction in opportunities for, and skills in, communication.

To conduct a professional practice as an exhibiting artist, graduates also need to expose their work to an audience, and art dealers, auction houses, and gallery managers are influential in this sphere. Dealers and gallery owners may educate the public about art, but they also select those artists whose work will be exhibited, and have a strong voice in establishing the price at which the work will be offered for sale. Confronted with the need for sales, many artists find their practice dominated by the need to produce and to reproduce what the market requires. The decisions of gallery owners, dealers, art critics and writers are frequently based on subjectivity, and all can sway the course of an artist’s career. Even so, gallery owners are sometimes faced with the challenge to sell difficult work. Cook (R. Cook, personal communication, August 28, 2004) advises artists to explore the exhibition potential of alternative spaces to expand their opportunities to show work to the public. That aside, artists need to be part of the art world system to have a voice in public discourse. The contribution of auction catalogue research, as well as its flaws, is noted, and it is proposed that a diminution in the levels of art scholarship could lead to an increased emphasis on exhibition catalogues as a source of information.

Nicholls points out that a society is interested in art when the basic necessities, such as food, shelter and clothing, have been satisfied, in accord with Maslow’s hierarchy of needs. Clancy agrees, but reflects that a society that has attended to its basic needs, but lacks art, would be the poorer in other non-quantifiable ways, such as a lack of a form of expression.

This chapter begins with a discussion about the essence of art, and concludes in a similar vein as the participants respond to the quote from Christopher Allen:
"The best art says things that cannot yet be put into words" (1997, p. 12). Scientist and artist alike connected with Allen's sense of what art means to those who are fortunate enough to be able to engage with art at any level, and helpful insights were gained that would not have emerged otherwise.

Benjamin, Castleden, Nicholls and Cleworth all agreed with Allen's sentiments, with Cleworth surmising that cutting-edge scientific and mathematical research would also deal with concepts that initially are not fully understood. McIldoe supports Cleworth's notion and states that often some of the most important breakthroughs in science answer questions that people did not even realise were questions at the time. His observations complement the notion of the 'discards' discussed in Chapter 11.

Clancy prefers to emphasise the "best things", and Kuhlaupt asks how does one define the "best art". McLachlan queries the use of the word 'yet'. He prefers "art can say things that can never be put into words", and claims that that is one of art's important characteristics. On a more prosaic level, Edmondston relates art's projected expressive qualities to the possible opportunities they provide for science communication, and Bunt links them with his discussion of the necessity or otherwise for didactic panels to accompany sci-art exhibitions (see Chapter 5).

One of the dominant issues in this chapter involves the tensions surrounding both contemporary art practice and contemporary art education. Some proponents of new media question the relevance of contemporary art practice and the conventions usually associated with art, and raise once again the cyclical spectre of the 'death' of art. The structure and delivery of contemporary visual art education is questioned from within and without the system. It would appear that the tensions within and between visual art education and practices have propelled them to the threshold of change. These tensions seem set to continue, and may well evolve into new forms and structures.
Endnotes


2 Julian Goddard is an academic, writer, and gallery owner, in Perth, Western Australia.

3 Dr Suzanna Biemoff, BA (History and Theory of Art), PhD, is Lecturer and Programme Leader, MA Film and Visual Culture, Middlesex University.


5 Where Theory Ends, There Art Begins, a conference held at Middlesex University, November 1998.

6 Maslow’s Hierarchy of Needs begins at the basic level of the physiological, and moves through safety, belongingness and love, esteem, need to know and understand, and aesthetic (art) to self-actualisation.

7 2004: Australian Culture Now, an exhibition at the National Gallery of Victoria (Ian Potter Centre) and the Australian Centre for the Moving Image, Melbourne, 08 June – 01 August 2004.


9 Sir Peter Williams is President, British Association.

10 Paper delivered at the Department of Cultural Studies and English seminar, University of Melbourne, June 04, 2003.

11 John Hartley is Dean, Creative Industries Faculty, QUT, and Stuart Cunningham is Director, Creative Industries Research and Applications Centre, QUT.

12 Irina Costache, PhD, is Associate Professor, Art, California State University Channel Islands, Camarillo, USA.

13 Jennifer Bott, CEO of the Australia Council, spoke at the Queensland Performing Arts Complex, on Thursday, 26 August, 2004.

14 Sara Fisher, The Duha Group, a colour collateral manufacturer, Australia.

15 Robin Chandler is a visual artist, sociologist, and lecturer at the Northeastern University, USA.

16 The exhibition See Here Now: the Vizard Foundation Art Collection of the 1990s, was held at the Ian Potter Museum of Art, the University of Melbourne, in 2003.

17 Siún Harrahan, BA (Hons) Fine & Applied Arts, PhD, is an artist, and an academic at the Dublin Institute of Technology.
CHAPTER 5

BIOLOGICALLY BASED ART PRACTICE

This [biologically based art] is art as philosophy, as investigation, not as decoration". (Jones, 2002).

Introduction

The research questions about the relevance of biologically based art to the public debate prompted divergent responses. One scientist was astonished by the preamble to Question 3, which states "At a time when the general public is sceptical about recent scientific developments", claiming that that was not the situation. The suggested scepticism, and the possibility that artists could unwittingly progress the cause of pharmaceutical companies, are raised in this chapter. Other issues addressed include the curatorial problems experienced by bio-art collaborators in finding suitable locations in which to exhibit.

Plants and animals have been modified through hybridisation and selective breeding for centuries, frequently to satisfy human aesthetics and expediency. In some cases, the products of these modifications have been exhibited as art. This thesis primarily addresses practices that engage with more recent biotechnology and medical advances that impact on humans, but a brief overview is provided of contemporary activities involving plants and animals to establish a context in relation to the exhibition of sci-art. However, as stated previously, ethical and moral attitudes towards biotechnology and sci-art are not examined in this thesis as they involve a specialised area of expertise.
Biotechnology and community risk perception

Catts and Zurr state that one of their main aims in creating their ‘semi-living’ sculptures is to bring biotechnological and medical advances to the attention of the public and to prompt discussion of the issues involved. Their premise of a need for discussion perhaps indicates an acknowledgement of a degree of public scepticism concerning these developments. Surveys commissioned by Biotechnology Australia indicate that there is scepticism in the community towards the uses of stem cell technology, cloning, and the genetic modification of animals and food products, but that the level of that scepticism has changed since 1999, as described below. The surveys were conducted in 1999, 2001 and 2003 to track public opinion on these issues. At *conVerge*, 2002, Cormick (2002) stated that key public concerns regarding biotechnology included “the perception that there are no adequate controls over the process, motivations and outcomes of the development and application for biotechnology and gene technology in Australia”.

Cormick’s (2002) assertion that “another key issue for any research body is how do you communicate what you’re doing to the public and do they trust you?”, is relevant to sci-art and its projected role of communicator. According to Biotechnology Australia’s Media Backgrounder, (2004, February 11), the 2003 study indicates more positive attitudes towards stem cell technology than in 1999 and 2001: “82% of the population support stem cell science but, perhaps unrealistically, expect it to improve our way of life in the next five to ten years”. However, the Key Findings (Biotechnology Australia & Millward Brown Australia, 2003, p. 4) report that “since 2001 the amount [sic] of Australians who felt that they could explain genetic engineering to a friend has dropped significantly (36% vs 31%).” The report advises that Australians are more likely to use the internet to find information on gene technology than more traditional sources, such as libraries, television, schools and books. The majority of biotechnologically based artists have their work accessible on the internet, but questions may arise as to whether the public would consider such sites as trusted sources for information on gene technology. However, bio-art is not limited by the constraints on other, more traditional, sources of information, such as those mentioned above, and has the potential to present differing perspectives to the public.
Cook’s (2002) appraisal of the biotech industry, prior to the international conference on the commercialisation of stem cell research in Melbourne, in September, 2002, highlights the dilemmas faced by bioscience and the scepticism of investors and the public. Miracle cures are many years away, he suggests, and, given that investors do not see further ahead than 10 years, stem cell research is confronted by financial and regulatory difficulties, he reports. Cook ponders whether Senator Boswell’s’ concerns that “drug companies, not children with diabetes or grandparents with Parkinson’s disease, will be the beneficiaries of embryonic stem cell research”, will prove correct (2002, p. 26).

Examples of world-wide biologically based art practices

Information about the research participants’ biotechnologically based practices and/or collaborations, where applicable, appears in Chapter 3. The works of other prominent Australian and international artists in the field are described in this segment. A focus is maintained on biotechnologically based work, and I do not venture into the expanding world of nanotechnology, the cyborg, artificial intelligence (AI), or virtual reality.

The number of biotechnologically based art practices has grown rapidly since the mid-1990s, and, in keeping with most art genres, it has no rigid set of criteria or boundaries. Therefore, to attempt a definition is difficult, but Pandilovski' (2004), curator of Art of the Biotech Era, 2004, in Adelaide, South Australia, offers the following:

At a technical level, we may say that such work represents a vibrant collection of moist interaction between bio-data stacks moving from the representation of the manipulation of bio-matter, as in the work of Patricia Piccinini or Mez, through to the actual manipulation of bio-matter, as in the work of Andre Brodyk, Eduardo Kac, Adam Zaretsky or The Tissue Culture & Art project [Catts and Zurr]. We would not be wrong in saying that artists utilise integrated media communications where the “space” becomes the space to be augmented, accented through a process of wide-ranging visualisation, across text, imagery, bio-matter and coding. (Pandilovski, 2004)

Pandilovski has witnessed an increasing interest in “wetwork”, or moistmedia as Ascott (2001) would have it (see Appendix C). Pandilovski regards the heightened interest as typical of the move by artists to ask questions regarding the moral, ethical
and aesthetic issues surrounding biotechnological advances. Pandilovski, among
others, predicts that the new art practices will investigate “new ways of living and
new possibilities for consciousness” (cited in Radok, 2004a, p. 28).

Brodyk (2001) lists five categories for genetic art practices: “(1) Virtual
sense (2) Physical sense (3) Biotechnology with living (4) Merger of Biotechnology
and living with digital technology (5) Synthetic organic/inorganic recombinant ready
mades.” He perceives that genetic art provides a cultural creative function that
permits a wider reading of, and engenders wider thought on, biotechnology. Brodyk
does not believe that it is genetic art’s role to assure the public of the veracity of the
scientific research behind the biotechnological developments (2001). In 2004,
Brodyk exhibited glo@k gene “based on the fact that current transgenic technologies
now make it possible to genetically engineer any living species with encoded genetic
material from any source including non-living ‘inanimate’ objects” (Brodyk, 2004).
His installation featured transgenic E-coli bacteria modified with either green or red
fluorescence from jelly-fish or coral organisms. As with Kac’s GFP [Green
Fluorescent Protein] Bunny, Alba, an albino rabbit genetically modified to glow
when exposed to blue light at 488 nm wavelength, the E-coli emit green or red light
when exposed to Ultra/near Ultra Violet light energies. The technology has already
been commercialised in the form of GloFish.

Originally produced and patented at the National University of Singapore, the
exclusive rights to GloFish were purchased by a company in Texas, USA. The
genetically modified red GloFish are now marketed in most states of the USA despite
discovery and opposition. Green, yellow and orange fish are scheduled for release
to the market in the near future. “The GloFish is a trademarked transgenic zebrafish
(Danio rerio) expressing a red fluorescent protein from a sea anemone under the
transcriptional control of the promoter from the myosin light peptide 2 gene of
zebrafish” (Hallerman, 2004). The promoters of GloFish recommend white light for
daytime viewing, enhanced by white gravel in the aquarium, and a black light when
the room is completely dark. Fluorescent green zebrafish from Taiwan have been
sold in Malaysia and Hong Kong. The import of modified fluorescent fish into
Singapore, Canada and the European Union has not, as yet, met with regulatory
approval. The development of commercial products from laboratory techniques and
developments is, in many cases, an anticipated outcome. However, as some
participants indicate, artists need to be cognisant of the consequences, advantageous or otherwise, of their involvement if their art works are appropriated to advance the cause of corporations or to facilitate the acceptance of the extraordinary as mainstream.

Gessert (2003) has been breeding hybrids of the genus *Iris*, and other ornamental plants, as his art form since the late 1970s, and his name is usually included in lists of artists with sci-art practices. He explains that, since he began to exhibit the hybrids as art, to his surprise, no-one has raised with him the issue of whether or not living plants are art. However, Gessert’s are not the first exhibitions of modified living plants in prestigious art galleries. According to Tomasula (2002), in the 1930s, Edward Steichen, artist, photographer and flower breeder, exhibited delphiniums of “gigantic size and colors never seen before” in the Museum of Modern Art, New York. Steichen used the drug, colchicine, to induce the genetic mutations in the delphiniums (Tomasula, 2002, p. 138). The obstacles Gessert faces in relation to public exhibitions arise more from social and architectural issues than philosophical ones. Selected images of hybrid streptocarpuses, from his *The Family of ‘Mark Tobey’*, were exhibited at Art of the Biotech Era, 2004. On some occasions, his exhibits are interactive. The audience is invited to make aesthetic decisions that affect the life and death of some of the plants, an exercise reminiscent of eugenics. However, Gessert (2003) discusses the consequences of exhibiting living non-human creatures in traditional spaces and asks whether such exhibitions “aestheticize the biological revolution”, and will they “speed the commodification of life?”

So far I have discussed sci-art dealing with fish, animals and plants. The ensuing discussion is about human subjects. Prior to 2003, Stelarc’s art practice would not have met the parameters for this study. Until then, he had been associated predominantly with installations and prostheses incorporating modifications to his body and, in 2002, he produced the *Prosthetic Head* described as a “live interactive embodied conversational agent” (Gye, 2004, p. 63). Potts (2002) describes Stelarc as a “techno-evangelist”, a futurist, who has a “distaste for past and nature” in view of his use of technology, including nanotechnology, to “supersede the body’s limitations” (p. 249). As with biotechnology, a growing number of artists are engaging with nanotechnology. However, it is Stelarc’s more recent collaboration with the TC&A that brings him within the scope of this discussion. In 1997, during
his residency at the Curtin University of Technology, Perth, Stelarc initiated a project to develop a graft tissue wearable prosthesis in the form of an ear, potentially to grow either behind his right ear or on an arm. It was proposed that the ear be formed with cartilage harvested from Stelarc's rib cage, then shaped into an ear framework, and placed beneath his skin in the preferred location. However, following discussion with Bunt, Stelarc established a project with TC&A to grow a ¼ scale extra ear, using the tissue culture engineering expertise of the personnel at SymbioticA. The Extra Ear ¼ Scale is a 'semi-living' creation which Stelarc is hopeful of eventually attaching to his body as a soft prosthesis.

Less invasive concepts are pursued by artists who take advantage of opportunities provided by new medical technologies. For example, Gary Schneider responded to the Human Genome Project with Genetic Self Portrait, a series of photographs based on parts of his own body taken with imaging technology during an eighteen month association with the Columbia-Presbyterian Medical Center, New York. To form Family Portrait, 2003, London-based Marilène Oliver used magnetic resonance imaging (MRI) scans of her father, mother, sister and self to form four sculptures created by screen-printing the scans in bronze ink onto sheets of clear acrylic. The sheets were placed upright, one in front of the other, to reconstitute the imaged "slices" of their bodies into whole figures. Oliver is aware of a huge potential in the poetic subversion of medical imaging. The translation of flat or screen-based medical imagery into sculptural objects allows the viewer to identify spatially with the imaged bodies and to repair their fragmentation/dislocation. (Oliver, 2004, p. 374)

Justine Cooper, an Australian now principally based in New York, created RAPT in 1998. She re-interpreted the work for Transfigure, 2003-2004. The video installation is based on MRI scans of the artist's body.

Shivers of recognition accompany us as we travel with the 'camera eye', effortlessly crossing the interior/exterior divide, watching as the body builds and falls away from itself in ghostly slices. The final sequence builds a head from back to front, slowly forming the image of a face. Despite the scientific accuracy of its representation, the face possesses a haunting, uncanny quality, which seems to challenge us to translate or incorporate this strange vision into the language we are comfortable using to describe ourselves. (ACMI, 2004)
In 2002, Cooper exhibited *Moist* at the Multimedia Arts Asia Pacific Festival in Beijing (MAAP). The video of bodily fluids magnified many times was created to suit a wall screen, but Ball's (2002) reaction is that the video “attempted a massive scale shift which resulted in a blotchy, grainy, abstracted image lost in the translation”. Most traditional artists are aware of the advantages and disadvantages associated with altering scale both in the ‘reading’ and presentation of work. Another source for the lack of engagement with the work could be that the video illustrated the movement of body fluids and did not attempt to interpret or comment upon the subject matter and, therefore, did not develop a dialogue with the viewer (see Chapter 4). Also at MAAP, 2002, Piccinini exhibited *Swell*, and her work was among those that were “well received”, according to Ball (2002).

SubRosa exhibited *Matrixial Resistance: Contesting patenting and privatisation of life materials* at BEAP, 2004, a presentation that incorporated performances, exhibits, and a laboratory project. Their concerns are similar to those of Sir John Sulston discussed in Chapter 7. SubRosa examines “alternatives to corporate proprietary science practices and the patenting of life materials”. The laboratory element of their exhibition uses umbilical cord blood, donated by artists, to create experimental cell lines to be made “available to independent amateur and professional researchers who wish to pursue non-copyright, experimental or contestational research in the public domain – using guidelines similar to those developed by the open source and copy-left movements” (Biennale of Electronic Arts, 2004). The same information sheet describes SubRosa as a “cyberfeminist collective” that combines “art, activism and politics to explore and critique the intersections of the new information and bio technologies on women’s bodies, lives and work”. Blond (2004c) reports: “With a series of quotes, they protest against the exploitation of biotechnology by men, but their installation is too much like a stand at a trade fair – clear communication but not much imagination” (p. 11). *Elfscan*, a video and technology based work at BEAP, 2004, by Agnes Meyer-Brandis, that parodies “the whole status of science in our culture”, met with Blond’s enthusiastic response (2004a, pp. 12-13).

The Belgian conceptual artist, Wim Delvoye, also uses installations. His *Cloaca*, 2000, constructed with an assortment of pipes, pumps and jars, processes food blended with water in a simulation of human bodily functions. It ‘eats’,
processes and excretes. During an exhibition in Antwerp, the resultant stools were signed and sold for US$1,000 each.

It would be remiss to close this section without a reference to the interaction of new media art practitioners with notions of a postdigital or posthuman existence, a significant subject but one beyond the scope of this research. Jonson and Tofts (2002) depict the cyborg as a portent of "a dramatic new phylum - the posthuman", and Tofts claims that the terms 'posthuman', 'cyborg' and 'informatic' are "different, yet complementary" (2002, p. 2). Punt (2002) asks whose vision of paradise will be progressed in the postdigital age

where the digital proposes the perfect finite conditions for a perfect existence regardless of matter (as for example in the human genome project), in the postdigital analogue (as for example in the ironies of genetic and wet biological art) human consciousness is regarded as almost infinitely malleable, able to shape its identity in response to local (and technological) conditions, while aware all the time of the range of possibilities (digital and analogue) that are not developed. (p. 120)

With the development of cross-species experiments, sci-artists will have further avenues to explore, but, as Tomasula (2002) points out, the technology used by Kac and his collaborators to breed Alba was applied to laboratory mice for approximately five years before the birth of the rabbit. The controversy only erupted after the event "due to the fact that science has become just that - art" (p. 143).

Curatorial concerns for biologically based art

The advent of "[computer] networking has the effect of destabilising the gallery/museum system just as it extends and enriches the scope (and perhaps nature) of individual creativity" (Ascott, 1989, p. 88). Ascott, along with other "pessimists" as Janousek (2000) describes them, predicts that digital technology will have repercussions for, and could bring about the disappearance of, the established gallery and art museum institutions. However, currently, biologically based artists claim many difficulties in having their work accepted into the mainstream gallery and museum system. Traditional artists experience similar difficulties and, although biologically based artists have dilemmas associated with infrastructure, as Benjamin points out the lack of venues is a concern for artists of all persuasions. As mentioned
in Chapter 4, Cook recognises that the shortage of exhibition venues limits opportunities for artists, and, at a professional development seminar for practising artists, he encouraged all art practitioners to investigate the possibilities offered by spaces outside the recognised gallery systems (R. Cook, personal communication, August 28, 2004). According to Benjamin, all artists have curatorial problems and limitations when preparing to exhibit. He believes it is part of an artist's remit to address situations as they arise and to work professionally towards a satisfactory resolution.

The notion of the 'two cultures' (see Snow, Chapter 2) is one factor that influences the non-acceptance of sci-art into established museums, according to Janousek. He calls for a reassessment of the philosophy behind museum and gallery organisation and envisages the future museum as one that networks to access the contents of other museums "exhibiting technical historical documents and presenting context through background and simulation (including virtual reality)" (2000, p. 24).

In the meantime, the public display of biologically based art work is subject to several constraints, as demonstrated by the precautions required for the exhibition Gene(sis), 2002. Subsequent to the terrorist attacks in the United States of America on September 11, 2001, and related concerns about biological terrorism, Held (2002) explains that the exhibition set new hallmarks for the inclusion of "biological artworks and artworks containing hazardous materials" at the University of Washington museum. Among the many precautions taken were safeguards for environmental health, guidelines for safety and risk management, and guidelines for the presentation and shipping of the biological art works. Held, the exhibition's curator, found that "the paranoia and bureaucracy was sometimes out of proportion to the project at hand and the relatively harmless materials employed" (2002, p. 5). Equipment breakdowns during exhibitions are additional concerns for curators.

During conversations about my research topic with members of the public, they frequently voice the frustration they experience when visiting technology based exhibitions only to find that some of the installations are not working. They state that they would prefer to visit the Scitech Discovery Centre, or similar permanent displays, because of their reliability. However, it is important to point out that many sci-art exhibitions are exploring new and difficult technologies that, as yet, are not
widely available. This highlights the difficult conditions under which galleries, who do not have the full-time technicians that institutions such as Sci-tech employ, work.

Members of the public inform me that, in addition to non-functioning exhibits, frequently the smaller venues do not abide by the advertised opening times and that the resulting annoyance is causing their enthusiasm for such exhibitions to wane. Blond (2004c) had a similar experience at BEAP, 2004: “Both Paul Vanouse and Stephen Wilson had large-scale interactive installations that used complex ideas and technology but unfortunately neither seemed to be working” (p. 11). Some non-technologically based artists claim that this lack of professionalism could reinforce the notion that all artists are careless and unreliable.

Bunt describes sci-art as difficult and costly to exhibit due to possible requirements and infrastructure, such as on-line gas, Faraday cages, and biological safety hoods. Nevertheless, SymbioticA first exhibited Fish and Chips in an opera house in Austria, where an electrophysiological recording laboratory, a tissue culture laboratory, and a cyborg were installed.

The establishment of curatorial criteria for sci-art is “crucial”, says Bunt. He recognises this as a big problem for biologically based art practitioners as they vie for acceptance by the mainstream art world. Sci-art is relatively new, and there has not been time to develop a critique or history of the genre to enable curators and critics to place it into a context. A glance through conference papers similar to those from Sins of Change, 2000, confirms Bunt’s assertions that new media artists are concerned about the lack of material available to inform and assist prospective curators.

Castleden does not consider herself qualified to comment on the curatorial concerns of biologically based artists. However, she volunteers that all living artists, as the creators of their work, continue to have a curatorial connection with it. Her point is valid. For example, Haacke declined to have his work exhibited in what he considered to be an inappropriate context. Nevertheless, in many instances, artists retain a tenuous connection with their work after it moves into institutional, private, and corporate hands.

Castleden raises another curatorial concern: the problem of the deterioration of digital prints. Many installation artists, including sci-art practitioners, use digital
prints to record the results of their work because frequently the art pieces cease to exist after the close of the exhibition. She notes that the permanence of digital prints is very limited; approximately fifty years, and to achieve one hundred years' longevity for a print it is necessary, with the technology available in 2003, to compromise the hue of the red. As Castleden points out, other art works are not immune from attacks by silverfish, from the effects of the vagaries of extreme weather changes, or from damage in handling.

Catts and Zurr state that they devote their sci-art practice to the critique of new scientific and medical technologies, and are aware that challenging, topical art often is relevant only to the time and place in which it is produced. However, they insist that this does not mean that the work is less worthy of exhibition, and biotechnologically based artists try to contextualise their work to the forum in which they are invited to present. These invitations are wide ranging and include "digital art venues, electronic arts conferences, performance arts, extreme art expressions, design, and sculpture". Catts and Zurr maintain that sci-art transgresses current notions of what art is, and the boundaries between the different art expressions, so that it is really difficult to pinpoint curatorial and other paradigms. They find this challenge adds to their commitment to their work.

Having a background in photography, Clancy is well aware of the "Ways in which photographers looked at painting to legitimise their practice." She does not recommend similar approaches for biologically based artists. She cites Gessert as typical of bio-artists who have encountered difficulties in finding a context in which to show their work, as galleries are not familiar with exhibiting life forms.

Curatorial paradigms are not needed for the actual creative process; they are more relevant to curators and the market, according to Cleworth. "The market is always looking for ways to package work to enable it to be bought and sold, and curators need a set of parameters to legitimise their frameworks." Therefore, he foresees that new media will be no different from other art forms, such as painting, in that, when it becomes neatly packaged, it will be very easy for artists to create work that fits within those artificially made boundaries.

Everyone has curatorial problems with new technologies, according to Kuhaupt, but the more adventurous and alternative projects are not easily categorised
by institutional staff. Curators tend towards work that is topical and, in the growing biotechnological field, multimedia is becoming more prevalent. Kuhaupt observes that:

in 2001, basically almost the whole of the Venice Biennale was screen based. The Australian representative at the Venice Biennale in 2001, Lyndall Jones, presented screen based work, and the Australian representative in 2003, Patricia Piccinini, also presented multimedia work. In reality, within the art world it is just mainstream. (Kuhaupt)

McLachlan agrees that there is a lack of contextual criteria for biologically based art in exhibition spaces, particularly as the establishment agenda tends to support art work that illustrates scientific concepts to aid the public understanding of science. Hence, galleries tend to say "Oh, we've done that. We did the public understanding of science." Thus he suggests that art work that is radically new, that is a "genuine fusion of science and art", unfortunately is grouped with the former illustrative work and is classed as "done" by the galleries. BZ Reaction, an audience participation exhibit within the Mental exhibition created by Storey and McLachlan, (discussed in Chapter 3), is an example of problems sci-art practitioners encounter when submitting proposals to galleries and other exhibition spaces. Although it was installed successfully at the Institute of Contemporary Arts, London, in July 2001, issues such as the handling of liquids, health and safety, and constant supervision have all contributed to the proposal being declined by other venues. However, McLachlan believes that the problem is "not actually about money, it is really about understanding." The activity of bodies such as Planetary Collegium, the Wellcome Foundation, the Australia Council and others supports McLachlan's assertion that there are funds available for sci-art.

McLachlan's other collaboration with Storey, Death Dresses, prompted Dent to write that the work was:

a thought-provoking, occasionally moving, exhibition in relation to both the psychological and biological spheres of death. Strangely, it was the biology that sunk into me, that stirred emotions in surprising ways. I never thought to be moved by cells, by that molecular journey towards the dying light. But these prêt-a-porter insights into the biological skins we're in were intelligent and beautiful by turn. (Dent, 2003)
Dent's positive experience could also reflect the skills of the curator and gallery owner who were prepared to be connected with a challenging exhibition that broached difficult subject matter (see Chapter 4).

Piccinini states that she has not encountered any difficulties with exhibition spaces and does not consider her art practice to be biotechnologically based. Her assessment could be predicated on the fact that she does not use wet laboratory material as a constituent of an end product, or that is the case according to my knowledge of her practice. However, journalists, reviewers and catalogue essayists frequently link the two. For example, Cregan and Scanlon (2004) observe that “there is an unbridgeable disparity between Piccinini’s desire to stir our emotions—to make us feel kindly towards all potential life-forms—and the negation of difference implicit in the biotechnologies her works are about” (p. 38). In addition, Engberg (2002) writes that “Piccinini investigated and embodied human characteristics within the technical world of digital environments, auto-mechanics and biotechnology to exploit cognitive acceptance and emotional attraction” (p. 07), and “Piccinini has explored the potential and the consequences of scientific, technological and medical intervention” (p. 08).

The market could also influence the curatorial decisions of galleries in relation to challenging biotechnologically based art. For example, sales of sci-art in Petri dishes are not possible in the vast majority of cases, and, therefore, in most circumstances, unless it is fully funded an exhibition of this type of work does not represent a sound business proposition for a commercial gallery.

Summary

From earlier exhibits of hybrid plants, bio-art has moved into new areas as evidenced by the recent access for artists to scientific wet laboratory facilities and the establishment of sci-art collaborations, particularly in the areas of stem cell technology and moistmedia. Other biotechnologically based artists use new developments in medical imaging, such as MRI scans, as a resource, whilst a few, such as Stelarc, investigate more invasive procedures. Some of these practices are described as questioning the moral, ethical and aesthetic issues surrounding biotechnological advances. However, surveys suggest that the public is sceptical about the ways in which the outcomes of stem cell technology and genetic
modification research will be applied to humans, to animals, and in food products,
and key concerns are associated with a perception that there are no adequate controls.
In view of this perception of a lack of adequate controls in the scientific context, it is
pertinent to mention that sci-art activity, possibly due to its conflation with art
practices, also does not fall within specific regulatory guidelines, although the French
government did intervene in the case of Kac's Alba as mentioned in Chapter 6. The
dialectical possibilities for change presented by sci-art, posited by scientists and
artists involved in such collaborations, suggest that these new practices are not
merely an aberration in the continuum of art, and that their influence has the potential
to extend further than is currently appreciated.

Representatives of the biotechnology industry are aware that there are issues
in communicating their research processes and outcomes to the public and that the
internet is now the most likely information source for Australians. Some observers
suggest that another traditional source of information, the institutional art gallery,
will be replaced in the future by an internet based information network.
Biotechnologically based art would appear to be an excellent vehicle for the
dissemination of information about scientific and medical research, and sci-artists
would broaden their audience potential if they could move their work from
traditional spaces with their regular constituents into venues or spaces more readily
accessible to the general public, an exercise Cook maintains all artists would be wise
to undertake.

Another concern of the biotech industry is investment for future research, and
some participants and others are concerned that the commercial interests of the
dominant funding bodies, such as pharmaceutical companies, will prevail over the
common good. Observers also express apprehension about the practice of patenting
'life materials'. In this regard, sci-artists, too, need to be aware of the ways in which
their work is adapted to, and presented in, the public arena.

Although, in some quarters, the artist is seen as the communicator of
scientific developments in an illustrative form to the community, some participants
are adamant that it is not the role of the artist to reassure the public about the veracity
of biotechnological research, but to provide prototypes or projections to stimulate
debate. Among the issues sci-artists claim to explore are possibilities for new ways
of living, new ways of physically being, and new ways of consciousness. These
notions aside, the technology used for Kac's *Alba*, and Brodyk's *glo*©k gene, has been commercialised in the aquarium trade to market GloFish. In a few countries this commercialised genetic modification in the form of GloFish has caused some debate, but, in others, the fish have been regarded as nothing more than another marketable commodity. Clearly, sci-artists face the dilemma that their products could be seen as prototypes for marketable products rather than art works to stimulate questions and debate.

Gessert was surprised that no-one interrogated the legitimacy of his exhibiting living plants as art. Any obstacles that do arise to his exhibition of the hybrid irises are usually of a social or architectural nature. Nevertheless, Gessert expresses his concerns, subscribed to by others in this study, that the exhibition of living non-human creatures in traditional art spaces will 'aestheticize' biotechnological advances and hasten the commodification of life. These undercurrents of concern, or latent content within the interview data, raise important issues that warrant deliberation; see Sarantakos (1998, p. 280) and Boyatzis (1998, p. 16).

Some sci-art participants claim that curatorial problems need to be overcome in order to achieve the satisfactory presentation of their work to the community. Snow's theory of science and literature, interpreted by many as science and the arts, as two separate cultures is cited as one philosophical reason some curators regard science exhibits as incompatible with an art gallery. A lack of historical background is another reason given as to why curators have difficulty contextualising sci-art. To claim a lack of history as a deficiency could be seen as disingenuous, when one takes into account the disregard many new media artists have for traditional art practices with historical links, as evidenced by the comments of Wilson, Catts and others in this thesis. However, there are a number of disincentives for commercial galleries to show some biotechnologically based art, including the lack of opportunities for sales, the cost of the technical infrastructure that is frequently necessary, and the technical unreliability of some exhibits.

McLachlan suggests that, while some institutions support sci-art that aids the public understanding of science, others avoid more radical work that addresses a genuine fusion of science and art: the institutions claim that they have already addressed the public understanding of science. Some participants also discern that
sci-art crosses boundaries between different forms of art expression and suggest that this creates difficulties for curators who try to locate the most appropriate context for new media. A body of material on which they could draw for background information and assistance could be useful for curators when assessing prospective sci-art installations. Further alleged curatorial anxieties, in some cases unfounded, include a fear of biological terrorism; costs of equipment and infrastructure; unreliability of equipment associated with developing technologies; and dangers to public safety associated with hazardous materials. Tensions between the need to increase the public understanding of art, and the dynamics associated with sci-art collaborations, are explored further in the next chapter.
Endnotes

1 Biotechnology Australia was established in 1999 and reports to the Australian Government Biotechnology Ministerial Council. Its partner agencies are the Department of Industry, Tourism and Resources; the Department of Education, Science and Training; the Department of the Environment and Heritage; the Department of Agriculture, Fisheries and Forestry; and the Department of Health and Ageing.

2 Craig Cormick is the Manager, Public Awareness, Biotechnology Australia, an author, and Chair of the ACT Writers’ Centre.

3 Senator Ron Boswell, from Queensland, is the National Party leader in the Australian Senate (at the time of the conference).

4 Art of the Biotcch Era was presented by the Experimental Art Foundation (EAF) as part of the Adelaide Bank Festival of Arts, 2004. Melentie Pandilovski curated the exhibition and is EAF Director. He was previously the Director of the Contemporary Art Centre, Skopje, Macedonia, and an initiator of the Skopje Electronic Arts Fair (SEAFAir) from 1997 to 2002.

5 Andre Brodyk is a genetic artist who writes extensively about the genre. Brodyk lectures in the painting studios at the University of Newcastle, and is a PhD Fine Art candidate at the College of Fine Art, University of New South Wales.


7 George Gessert (1944-) (USA), studied English literature and painting at the University of California, Berkeley, and the University of Wisconsin, Madison. He has exhibited extensively in Europe and the USA, and is the art and biology editor for Leonardo.

8 Stelarc (1947-) was born Cyprus and lives in Melbourne, Australia. He works internationally. In 1997, Stelarc was appointed Honorary Professor of Art and Robotics at Carnegie Mellon University, and in 1999 was re-appointed as a Senior Research Scholar for the Faculty of Art and Design at the Nottingham Trent University. He received an Honorary Doctor of Laws from Monash University in 2000.


10 Transfigure, an exhibition of cutting edge film technology, was held at the Australian Centre for the Moving Image (ACMI), Federation Square, Melbourne in 2003-2004.

11 The Multimedia Art Asia Pacific (MAAP) Festival was staged at The Art Museum of China Millennium Monument, Beijing, October 20 – November 2, 2002. This was the first time the Brisbane-based MAAP had held its annual new media art festival outside Australia.
12 Michael Punt is Editor-in-Chief of Leonardo Reviews and a member of the Leonardo/ISAST Advisory Board. He is associated with the Planetary Collegium, and Reader in Metatechnology, University of Wales Newport, Wales.

13 Ivo Janousek is Director of the National Technical Museum, Prague, and a specialist in cybernetics, philosophy of science and culture. Janousek is also a member of the Board of the European Collaborative for Science, Industry and Technology, and the Committee for the History of Technology, and is vice-president of the Middle-European Union of Technical Museums. He lectures in logic and epistemology at the Charles University, Prague.

14 The Sins of Change: Media Arts in Transition, Again conference was held at the Walker Art Center, Minneapolis, April 6-8, 2000. One of the many websites with information on the conference is: http://absoluteone.liudmila.org/sins.php
CHAPTER 6

COLLABORATIVE PRACTICES BETWEEN SCIENTISTS AND ARTISTS

Art disturbs, science reassures. (Georges Braque, Le Jour et la Nuit.)

Introduction

This chapter draws upon the input of scientists and artists from different perspectives: half of the participants have engaged in sci-art collaborations and half have not. In particular, Question 4, “To what extent do you think science is appropriating art to navigate a path between the scientist and the public”, raised the ire of some of the collaborative scientists who considered it asymmetrical. However, all participants were asked to respond to the mirror hypothesis that art was appropriating science. With no knowledge of the scientists’ reactions, one artist commented that it was an interesting question with “some real pepper in it”.

I have chosen to use the term ‘collaborative’ to head this chapter because it seems to me to describe the atmosphere I sensed when I visited the wet laboratory at SymbioticA, where scientists and artists appear to enjoy a free exchange of ideas, knowledge, expertise and opinions. Although the term collaboration is used by artists and scientists in writing about sci-art, some participants commented that scientists who are not closely involved in collaborative partnerships are more inclined to think of the artist as an illustrator of scientific concepts. Additional terms, such as intersection and interaction, are used in the body of the text.

Governmental and institutional interest

Governmental and institutional funding is a prime factor in facilitating sci-art collaborations, particularly as the government funding agencies are now placing greater emphasis on supporting projects promoted as partnerships. Rowley observed
at conVerge, 2002, that scientists frequently talk about their collaborations with artists as linkages. Such terminology is in keeping with the ethos of the Australian Research Council (ARC) as Rowley outlined at a Creative Arts seminar at the Western Australian Academy of Performing Arts (WAAPA), in Perth (S. Rowley, personal communication, May 21, 2004). Her model of sci-art collaboration does not foresee artists initiating scientific breakthroughs but in artists enabling a better interpretation of scientific process, the education, communication and nurturing of community awareness and indeed acceptance. I have many long discussions with one of my CSIRO [Commonwealth Scientific and Industrial Research Organisation] colleagues about community acceptance of issues like genetic modification. I’m not sure that should be our prime task here but it is a task that we could take. Finally, scientists are interested in our ability to assist them in showcasing science as aesthetic and scientific processes as aesthetic in themselves [italics added]. (Rowley, 2002)

Rowley’s notion of art showcasing science is contentious in relation to issues of illustration and soft science that concern some participants. Another key area of Rowley’s purview is the government’s stress on innovation and commercialisation, and she foresees opportunities for artists “to push the boundaries of scientific development, to problem solve and to challenge paradigms and perspectives” (Rowley, 2002). More extensive comments on the government’s push for innovation, and other research funding issues, are presented in Chapter 7.

In the United Kingdom, the National Institute for Medical Research (NIMR) offers a NIMRart programme. Residencies associated with NIMRart are usually awarded for a period of three months, based on two or three days per week, and are open to international artists. The institute’s interest in a scientist and artist collaborative programme is in the benefits that could arise from the dialogue between the participants, and the new perspectives that the parties bring to the work.

Their tools and their products may be very different but contemporary artists and research scientists are both question-askers, researchers and experimenters, and producers of “stuff”. The NIMRart encourages this relationship between the artist and the scientist, preferring significant discussion, integration and process over superficial relationships and product.
Authorship, intellectual property and copyright

Authorship – or collective authorship – and who makes decisions regarding the exhibition of work, copyright, and intellectual property, are important questions for sci-art collaborators, and, indeed, any multidisciplinary interaction. Parties with a proprietary and/or ethical interest could include government agencies, universities, sponsors, technical assistants, scientists and artists. Kac’s *Alba*, a green fluorescent rabbit, has been detained by the French government in the laboratory where it was bred, despite similar technology being used for the genetically modified GloFish pets now being made available in most American states, and in parts of Asia, (see Chapter 5).

Copyright is another issue. For example, the grass based hyperspectral imaging project initiated by artists Ackroyd and Harvey is a situation where copyright problems could arise due to the possible commercial applications of the collaborative research outcomes. For further details of this project see Chapter 7.

Copyright is again an issue when artists are asked to do work as a favour, a situation with which many artists are familiar. The majority of the people who approach artists would not consider asking most other professionals for free services. An example of this is the rarely attributed art work of Elizabeth Kendrew who drew the structure of the DNA double helix for Watson.

If we examine Watson and Crick’s paper, we encounter the first artwork that is of central relevance to the Henry Art Gallery exhibition. The paper contains a single figure, which is the first drawing of the double helix as a representation of DNA. It ranks among the most famous visual images in the whole history of science. I actually had to do original research to find out who the artist was. There is no mention of the artist’s identity in the paper, none in *The Double Helix*, Watson’s memoir, none in any of the historical treatments of the discovery that I have read. I have always been struck by the artistic force of the figure, which displays an elegance and level of abstraction rarely encountered in a technical paper. Indeed, the artistic interpretation of the double helix in the initial Watson-Crick paper has become a major icon of our culture. To satisfy my curiosity, I asked Jim Watson who drew the picture, and he said that it was Elizabeth Kendrew, his tennis partner. So, Elizabeth Kendrew is the first artist who addressed the central theme of this symposium. (Olson, 2000)
Kendrew's original pencil drawing could be the one Connor asserts hung over the scientist's desk (Connor, 2003). However, the Economist (The art of DNA, 2003) reports that "their [Crick and Watson's] paper also included a simple pen-and-ink drawing of the molecule, by Odile Crick, Francis's wife". In either case, the lack of acknowledgement of the artist corresponds with the scant recognition given, at the time, to the work of Dr Rosalind Franklin, whose pivotal contribution to research into the structure of DNA has only been highlighted recently, in biographies and television documentaries. Ingham (2003) refers to Franklin's X-ray photographs of the molecule, [given to Crick and Watson by Wilkins, Franklin's colleague, without her permission,] which proved vital to Crick and Watson, and the alleged misogynist attitude she experienced at the hands of the "male scientific establishment" (p. 11).

Why does science interest artists?

Bijvoet (1997) claims that artists generally lagged behind science by approximately twenty years in the early 1900s, but caught up in the latter part of the century. In this later period, technology and science began to work closely together "for economic as well as political reasons" (p. 15). Despite Bijvoet's inference that artists were "out of the loop", in Chapter 11, I venture that there were instances where artists envisioned scientific phenomena before science provided evidence of the phenomena's existence, both early in the twentieth century and more recently. In particular, it is the human genome project that many consider prompts community curiosity and interest in biotechnological developments.

Like other arenas of culture, contemporary art is deeply implicated in the ultimate meanings of the human genome.... More importantly, it [Gene(sis)] exploits the power of contemporary art to provoke, to question and to articulate new paradigms, providing conditions necessary for a deeper understanding and a fuller discussion of genomic issues. (Held, 2002, pp. 2-3)

Catts and Zurr suggest that the extent of public scepticism about recent scientific developments has induced artists to seek access to scientific laboratories. They assert that most members of the public are not well informed about the new technologies, and this leads to negative responses, in some instances, from fear of the unknown. Because of this apparent lack of understanding of scientific discoveries in the community, Catts and Zurr suggest that it is useful for artists to collaborate in
scientific laboratories, to look and learn about the issues, and then to comment publicly upon them. They detect opportunities for exploration of scientific developments by both traditional and new media artists, but note that many of the artists who are active in this field realise that our belief systems and cultural tools are ill equipped or inadequate to analyse the potential outcomes of the new technologies. Their notion about belief systems is discussed in Chapter 9.

Some participants suggest that art is a means of examining existing belief systems and the Economist, (The art of DNA, 2003), states that the arts provide a ready forum for debates, particularly those that reflect "popular anxieties about social control, conformity and commoditisation [sic]". The paper nominates Bryan Crockett's *Gluttony,* 2001, as an example of an artist commenting on "the business of biotechnology". Although the paper claims "*Gluttony* is a model of an animal modified to become obese, so that it can be used in the laboratory to study diabetes", the assertion is an over simplification, possibly due to lack of space, and does not convey Crockett's overall intent. Crockett addresses the growing authority of the rationality of science in western society, and the "spiritual void in contemporary technological culture" (Lehmann Maupin, 2002). Piccinini's *The Young Family,* 2002, has similarities with *Gluttony*. Both artists present sculptural forms with connotations of human facial expression, and with surface qualities evocative of human skin: Piccinini uses silicone, acrylic, human hair and leather, while Crockett creates historical links with marble statues and the human body, by using ground marble cast with contemporary polymer binders. However, Piccinini's concern is the concept of the family as a community.

Clancy identifies opportunity, curiosity, and a sense of adventure as factors that influence artists to collaborate with scientists. Rather than being necessarily more concerned than other people about, for example, genetically modified foods, she lists "fascination, a certain level of affinity, or attraction, or repulsion, towards the material and ideas" as aspects that encourage artists to practise in the biologically based art field.

Long states: "I think that more artists are becoming involved in science because it is such a topical thing in the world today, and there is such a high degree of scientific illiteracy in the community."
Who initiates sci-art collaborations?

A Swiss initiative, co-ordinated through the Hochschule für Gestaltung und Kunst Zürich (HGKZ), offered twelve artist residencies in nine laboratories for 2004. The programme was conceived in 2002 by two academics, one from science and the other from art: Professor Marille Hahn, Research and Development, University of Applied Science, Aargau; and Professor Jill Scott, HGKZ. The aim of the programme is to focus on "transdisciplinary methods of collaboration between the applied and theoretical worlds of art and design ... and the disciplines of science — including the scientific procedures of visualization, interpretation and knowledge" (Artists in Labs, 2004). The various areas of research offered included AI, robotics, biochemistry, nanotechnology, and genetically modified organisms. The recipients came from Europe, the USA, Singapore, Australia and India.

A new exhibition about the brain tries to bring visual arts and science together. But it's a false premise. Art does not help us understand how the world works — and to merge the two disciplines trivialises them both. (Wolpert, 2002)

Wolpert denies any value in pursuing art and science collaborations. He contends that "artists are envious of scientists and scientists want to be thought of as artists", and that "an element of social snobbery" resides in any idea that the visual arts are similar to science (2002). On the other hand, Carnie suggests that art is too important to be left to artists — science too important to be left to scientists. Bringing the two together raises provocative and interesting ideas about fundamental issues on the nature of creativity, the role of education in shaping disciplines and the funding of culture. (Carnie, 2002)

Carnie exhibited Magic Forest in the Wellcome Trust’s Head On: Art with the Brain in Mind exhibition, at the Science Museum, London, 2002, and asserts that the public has an interest in viewing and assessing the results of sci-art collaborations, particularly as aspects of the two disciplines can be either "intriguingly similar or profoundly different" (Carnie, 2002).

Jacob, one of the founders of "Signatures of the invisible", a collaborative project based at CERN, indicates that he aspires to bridge the gaps between political and cultural ideologies. The project involves CERN with the London Institute, and
two artists, Richard Deacon and Anish Kapoor, who will visit CERN for two months to work with physicists. The resultant art work is scheduled for world-wide gallery exhibitions (Cartlidge, 2000). The scientists at CERN are experienced in hosting artists: for example, Monica Sand, a sculptor, who says her main interest is “space, and how light shapes space”, has been visiting CERN over a period of eight years.

Also connected with notions of space, a diverse trio: John Barrow, a cosmologist from Cambridge University and author of *The Artful Universe*; Martin Kemp, an art-historian; and Richard Bright, an artist, initiated a collaboration sponsored by the Wellcome Trust. Their project is based on the hypothesis that the wide use of perspective as a visual aid is "limiting the ability of scientists to represent complex spaces" (Cartlidge, 2000).

Mukerji (1994) interprets sci-art collaborations as examples of practices where "the movement of scientific material practices beyond the lab ... contributes to the overall power of science and technology to the culture" (p. 157). On the other hand, the power Mukerji notes is attributed, by several scholars, to science in western social and cultural life, and could be the very reason artists find a sci-art collaboration challenging, and scientific claims legitimate subjects for investigation.

Science is revered because it epitomizes the rationality of modern life, because it is the legitimate voice of capitalist development, because it is a system for the rational exploitation of resources, because it has powerful advocates, because it is the knowledge system that most frequently “works” (whatever that means), because it is written in a language of measurement and precision that gives it authority, or because it is used by and is useful politically for the modern state. (Mukerji, 1994, p. 143)

Many of the participants mention science’s perceived difficulty with communicating its research outcomes to the public. According to Vesna (2000), inappropriate references to scientific phenomena by philosophers and intellectuals are also confusing. As an example, Vesna turns to a parodic article published by Sokal in 1996. Sokal takes comments about physics and mathematics by prominent intellectuals, such as Lyotard, Derrida, Irigary, and Lacan, and re-contextualises them into nonsensical quotations. He makes frequent references to scientists, such as Heisenberg, Kuhn, Bohr, Harding, Bell, and Gödel. "The references cited are all real, and all quotes are rigorously accurate; however, having been taken out of their
cultural contexts and reframed, they do assume questionable meanings" (Vesna, 2000, pp. 9-11). Following the interdisciplinary debates that erupted following Sokal's hoax, and the publishing of "Intellectual Imposters", "one positive result was that the controversial issue was openly discussed. The negative ramifications of this debate included the endangering of "the very fragile bridge between the humanities and sciences", and the possible concerns of funding bodies for scientific research (Vesna, 2000, pp. 9-11). This suggests that collaborations initiated by either artists or scientists could forge a closer empathy between the two cultures and help to lessen the possibility of misunderstandings and misinterpretations in the future.

One of the earliest organisations established to foster dialogue between scientists and artists is Experiments in Art and Technology (EAT), founded in 1966 by Kluner, a Swedish engineer, and Rauschenberg, an artist. EAT was still operating in New York in 2004, but it is not the force it once was. EAT’s original purpose was to facilitate artists’ access to new materials, technology and engineering, and, to that end, developed government and corporate networks. According to Burnham (1980), EAT was very successful in gaining substantial amounts of money, but fell into disrepute when it had a public disagreement with the PepsiCo, Inc over $405,000 in relation to a planned Expo ’70 pavilion in Osaka. Disaffected members claimed the organisation was "elitist" and ignored the needs of the general constituency in favour of more high profile members and staff (Burnham, 1980). However, Burnham, exhibiting healthy cynicism, no doubt fostered by his unfortunate experience with the technology based exhibition Software, 1970, claims that, although EAT approached corporations for funding, "most companies were cynical and wise enough to realize that the research abilities of nearly all artists are nil. What companies could expect is a limited amount of good press for appearing ‘forward looking’" (1980).

Wilson (2002) remarks that the early EAT collaborations did not consider the artist’s role as one of researcher but rather as consumer of the new technologies, with the scientists and engineers acting as technical support (2002, p. 36). Wilson is adamant that the artist today needs to be involved as a researcher, but Bijvoet (1997) recognises that, in 1965 and 1966, artists were seeking to extend the boundaries of art and to gain access to technological advancements (p. 17).

Initiatives also took place in Australia at that time. In the mid-1960s, the University of Western Australia (UWA) installed Hans Arkeveld," a traditional
artist, in the Department of Anatomy and Human Biology. Arkeveld pioneered the collaboration between artist and scientist in the Department, and the success of his residency has helped to develop a positive attitude towards the involvement of artists, and to pave the way for the establishment of SymbioticA. That aside, during a meeting in March, 2002, Catts and Zurr suggested to me that artists with a traditional training and practice would probably adopt the commentator role in relation to scientific developments.

Building on these earlier initiatives, artists and scientists now collaborate and provide artists with access to new scientific and medical developments. Purves (1998) believes these interactions bring "new methodologies, rather than new subjects, to the practice of art".

Along with Purves' assertion of new methodologies, Bunt claims that the new materials developed through recent technical and medical advances, and made available to artists in scientific collaborations, constitute an important innovative and stimulating ingredient in the move towards an expansion of transdisciplinary interaction. In their report on the BRIDGES' summit of 2002, Pearce, Diamond, and Beam (2003) reflect on the perceptions interdisciplinary projects could stimulate and suggest that such projects could, in themselves, develop into a "meta-discipline" encompassing "scientific visualization" (p. 125). This is an interesting hypothesis, given that scientific visualisation, both to assist researchers in interpreting data and for public viewing, is a burgeoning field particularly in the area of fractal geometry, chaos theory and space exploration. The aesthetically attractive images created by digital enhancement of data transmitted from satellites are assisting scientists to communicate the results of their space research to a wider audience in a form that can be understood by the lay person.

Bunt was provoked into an animated response by the suggestion, in Question 3, that "artists have agreed to collaborate with scientists". In his experience, in approximately ninety-five percent of good sci-art, it is scientists who have agreed to collaborate with artists. However, Bunt nominates Joe Davis14 and Adam Zaretsky15 as artists who beleaguered scientists until the latter agreed to collaborate with them. Davis' philosophy is that an artist needs to work with the "tools of cell and molecular biology" because "art is about communicating. How can you convey something you don't have a clue about?" (cited in Nadis, 2000, p. 668). Davis' presence has
prompted some of the scientists to think outside the normal scientific paradigms but not everyone is pleased to have Davis in the laboratory, and some scientists told Nadis that the bench space would be more profitably occupied by a scientist (Nadis, 2000, pp. 669-670).

On the other hand, Bunt proposes that, when an artist agrees to collaborate with a scientist, the results are frequently the illustration of a scientific concept, in “pretty pictures”, which Bunt does not consider “good” sci-art. “Paintings and scientific illustrations seem to spring from two quite different worlds” (Schenk, 1960). During collaboration with the National Science Foundation (USA) in relation to artificial intelligence (AI), Wilson (2002) found that, although he contributed constructively to the discussion, the assumption was that his main function was “to beautify the reports submitted to the government” (p. 37). Timms (2004a) notes that photography is a means of producing macro or micro images that can be “spectacularly beautiful and moving in their own right” and help to “blur the distinction between science and art” (p. R19). Although some galleries accept illustrative works for exhibition, artists with whom I have discussed this dilemma deem as dubious the claims that such pictures are art.

According to Long, SymbioticA is a collaboration funded through government but initiated by artists, not by scientists. He points out that, in his opinion, the artists take part in a project to integrate artistic concepts with science and to promote both art and science simultaneously.

Asked about his reaction to Patsy Payne’s approach regarding the Positron Emission Tomography (PET) scanning, Meikle responded that “it was a little unusual ... but the approach did not come in that way initially, it was one of those things that evolved.” In an endeavour to find alternative, more meaningful, ways to visualise their data, in addition to the conventional cross-sectional slices of the body, the Royal Prince Alfred Hospital (RPAH) PET Department began to use the VisLab facility at the University of Sydney. Coincidentally, Payne was using the facility as an alternative medium to look at images of the body. From this chance meeting, discussion developed and resulted in the artist proposing a project that, although unusual, evolved into something useful for all concerned.
On the issue of whether artists initiate projects, or vice versa, McLachlan tells how his collaboration with Professor Helen Storey, a designer, came about. Prof Storey and her sister Dr Kate Storey, a developmental scientist, had worked together on a Wellcome Trust funded project *Prmitive Streak*, 1997. When McLachlan saw the media images of the high fidelity representations of human embryos as dresses, he recognised the potential of this type of work for teaching purposes: as "something slightly off the wall to re-engage the students' attention". He telephoned Storey to seek permission to use the images and, following their meeting and further discussions, they decided to apply for funding to work on a collaborative project. Storey and McLachlan developed a sound working relationship prior to commencing the collaboration, a circumstance McLachlan maintains is vital, because if one party has "a very specific project in mind and then goes looking for a scientist or an artist to fit", the creative agenda could be subverted and the outcome disappointing.

In the technologically sophisticated world of today, a creative sci-art agenda needs expensive equipment that necessitates commercial or research funding, and this could see art becoming more reliant on the resources available to science. On the other hand, Munster (2001) queries whether a cash-strapped science could decide that the illustration and communication skills of art make it a worthy bedfellow.

Is it too naïve to hope that these strange hybrid objects that are now manoeuvring their way along and shifting the art/science borders, do not too readily become assimilated into a unifying terrain for a drab, instrumentalised technics that is bereft of any ingenuity? (Munster, 2001, p. 23)

Munster has plenty of company when she associates art with a communication tool. Dewey observed in 1934 that "In the end, works of art are the only media of complete and unhindered communication between man and man that can occur in a world full of gulls and walls that limit community of experience" (Dewey, 1958, p. 105). Since that time, tumultuous changes have occurred in the means of communication, but the participants in my research, and many contemporary writers, still proclaim the facility art provides as a communication tool.

As these interdisciplinary collaborations move into ever-increasingly complex areas, Punt (2004) warns that the postdigital era (and, as others indicate, the
posthuman and cyborg era), will bring with it the challenge "to consider how knowledge might be extended, codified and distributed in a multiverse of collaborative realities" (p. 201). Tarlow (2003) reports that Jacobson senses a difference in perception of outcome between a scientist and an artist. These differences relate to the discussion of creativity in Chapter 8, but Jacobson's comments are included here as they provoke thought on an issue that could affect future collaborations.

When looking through a microscope at a dissection or an x-ray, a scientist asks, "What is the content of what I am seeing, and what are the implications?" while the artist asks "How does this appear, and how can I transform this into an aesthetic personal, or historical/cultural statement?" The phenomenology of viewing is paramount for the artist, and veracity means only that the subject matter be visually believable within the imaginary world the artist has established for the viewer. (cited in Tarlow, 2003, p. 22)

The function of collaborative sci-art

The best sci-art is very rarely art for art's sake, according to Bunt, because it engages with and comments on science. He states that sci-art would be trivial if it only comprised "pretty pictures". In addition, Bunt concede that, because the intention of sci-art is to engage with the actual substances in the wet laboratory and it is, therefore, closely connected with the scientific material, sci-art is sometimes criticised as non-art. This situation raises a dilemma for some traditional artists who accept a residency at SymbioticA.

Collaborations between artists and scientists at SymbioticA often move along paths different from the close liaison expected between parties who work in the "wet laboratory" situation. Although the work produced by some of the traditional artists following their residency has been influenced by their experiences at SymbioticA, it represents art for art's sake, according to Bunt. In his opinion, there is "biologicalness" but no deep philosophical reason behind the work. This art for art's sake illustrates science, it does not critique science. In contrast, he says, a critique of science is the prime concern of the work produced by The Tissue Culture and Art Project. As Bunt would have it, work like MEART does not necessarily flatter science but it draws people's attention to what is happening in science, and it
does, in some ways, illustrate science. Nevertheless, he claims it is different from the
art for art’s sake work he comments upon in association with the more traditional
artists. Although Bunt found it difficult to be precise about the difference, he
suggests that, in part, it relates to the response of the viewer: for example, viewers of
Worry Dolls usually have strong reactions ranging from intense dislike, to not being
moved by it, to going away with a variety of thoughts, or to being moved to tears at
the death ceremony.

Munster (2001) observes the way in which artists interact with technobiological issues and the message their work leaves with the viewer. The ‘semi-living’ sculptures, Worry Dolls, appear to her to prompt consideration of the degree to which the public should accept scientific developments in “faith” and the “borderline status of the animistic-technical object produced as a moment of both scientific and aesthetic invention that makes us wonder about the ethical directions in which such art/science endeavours are heading” (Munster, 2001, p. 20). Munster juxtaposes Piccinini’s SO2 (Synthetic Object 2) digital images with Worry Dolls.

The crisp banality of the scenes she photographs and the jolt that comes from realising her manufactured life form is no longer out of place in everyday life, is a salutatory [sic] reminder that organic artificiality is already assumed as part of the “natural” cultural and scientific landscape. Art and science are here conjoined on the plane of technical artifice. (Munster, 2001, p. 20)

What has prompted the interest in sci-art collaborations?

The possibility for sci-art collaborations arose from the social, economic and technological changes that occurred in the early twentieth century, and the interest shown by visual artists in these transformations. Stangos (1981) points out that, although artists found new areas of interest in the scientific developments taking place, they did not necessarily understand them.

The new scientific ideas were simply in the air (through the mass media, etc.) and, regardless of whether or not they were understood, they helped channel imaginative activity in new directions and also encouraged experimentation even when they were totally misunderstood. (Stangos, 1981, p. 8)
Stangos highlights the notion of the scientific ideas being ‘misunderstood’,
and some scientists allege there is an ‘anti-science’ ethos in the community. The
question of lack of communication skills in some areas of science is mentioned
frequently by the participants in my research, but Turney (1998) discerns other forces
at play. For instance, he cites Professor Lewis Wolpert, in his capacity of chairman
of the British Committee on Public Understanding of Science, who “chastises the
media for what he terms ‘genetic pornography’”, a claim for which Turney asserts
there is no evidence. Turney reveals also that “The outgoing editor of Nature
summed up the feeling in a revealing jeremiad bemoaning ‘the prevalent mistrust of
science’ at the end of 1995” (1998, pp. 3-4). While doubting the existence of a strong
mistrust, Turney agrees that there is “ambivalence” towards some sciences and that
biologists are aware of this but “they consistently ascribe it to general anti-science
sentiment, ignorance or media misrepresentation of their work”. He quotes two
prominent scientists, Medawar and Davis.

I find it difficult to excuse the lack of confidence which otherwise
quite sensible people have in the scientific profession ... for their
fearfulness, laymen have only themselves to blame and their
nightmares are a judgment on them for their deep-seated scientific

Davis, too, is concerned that the lack of public confidence in genetic
engineering will impact on the potential for biotechnological advances:

it [public suspicion of genetic engineering] has added one more facet
to a more general scepticism about the goals and the social impact of
science and technology... This antiscience movement poses a threat,
more than is generally recognised, to public support of science, the
recruitment of promising students, and ultimately the morale of
working scientists. (Professor Bernard Davis, 1991, cited in Turney,
1998, p. 4)

Turney’s book takes as its departure point Shelley’s Frankenstein, but it
finishes on a constructive note for the future interface between scientists and the
public. Scientists are authorities in their field and he advises them to use this
authority to inform the public about the rapidly moving developments in
biotechnology that ultimately affect all parties. In this way, all members of the
community will be in a better position “to weigh up new techniques and procedures,
to make new decisions, to decide what is acceptable, which paths should be blocked,
to make sense of the ultimate promise to reconstitute ourselves" (Turney, 1993, p. 221).

Turney advocates storying as a tool for the wider dissemination of possibilities and debate, and, from those stories, he suggests choices can be made about the way forward. Of course, visual artists, too, work with narrative and can interface with science to contribute to the stimulation of debate and the dissemination of possibilities.

Bunt notes the long association between science and art, and reflects on a significant change. The sciences, particularly the biological sciences, are more visible and have more impact in daily life now. He asserts that this visibility and impact have aroused more awareness and debate, resulting in wide discussion of topics such as genetically modified food and organ transplantation.

Bunt prefaces his next comment with an acknowledgment that artists will “hate” his use of the word, but, in his opinion, art is “following” the expansion in the sciences, and that art has been “struggling” with this state of affairs since about the 1980s. He claims that, prior to the 1970s and 1980s, art was at the cutting edge of discourse and led debate on issues of the day, but it lost the initiative to science and is still trying to catch up. Bunt believes art will become irrelevant if it does not engage in debate about current major issues emanating from science and technology. As Bunt would have it, “some people would say” that traditional art was superseded by conventional photography and has become merely pretty pictures and illustrations. He nominates Eduardo Kac as among those who espouse that view. Nevertheless, he acknowledges that this is an extreme view and that bio-art, whilst having the distinction of being regarded as “new” due to the development of more and more new technologies, is, in many instances, very repetitive.

With regard to “straight science”, Catts and Zurr recognise “that scientists feel that they have lost contact with the wider community” and have a problem communicating the potential of their discoveries. This is a recurring theme throughout the interviews. Catts and Zurr found that:

when we approached scientists, in many cases they were so amazed that someone else was interested in their work that this opened doors for us. Obviously they saw sci-art as a vehicle for them to expose their work to the wider community in a way they
found, or initially they found, non-threatening. Obviously, after seeing what we are doing, some feel more threatened by that. (Catts and Zurr)

The sentence in italics relates to the reaction the artists have experienced when, in the opinion of some scientists or sponsors, their work has critiqued the scientific discoveries rather than illustrated them. However, the more they work with scientists, Catts and Zurr realise that, instead of art and science being opposites, there are many similarities. There are different forms of art, different areas of art expression, and different intentions by artists, and the same is true about science. A good example of different forms of expression is the mouse with the ear on its back and the problem of how to communicate the potential of tissue engineering to the public. (Piccinini's Protein Lattice series, 1997, appropriates the idea of the mouse with an ear on its back.) Catts posits that:

the actual experiments did not succeed, so it has become the most glorified failure because the fact that it failed was never revealed to the public. The image did, however, open up the imagination, and in my perspective it is one of the most important images of the late twentieth century [italics added]. It has really achieved a goal as a communication piece rather than a scientific piece, but it was made by scientists, so sometimes the roles cross over. (Catts)

Whilst in Germany in 2003, Catts visited some artisans' collaborations. He found circumstances there that resembled those in other organisations in that some artists visit a laboratory for a couple of hours, have a short discussion, perhaps obtain some imagery from the researchers as a form of inspiration, and then return to their studio and produce very superficial work. Here Catts stresses the different protocol that pertains at SymbioticA where artists are encouraged to spend time in the laboratory on a daily basis, and to engage and be critical, rather than to disappear back into their studios. Zurr maintains that, at SymbioticA, artists and scientists are regarded as equals in the allocation of space, and in other ways.

Clancy welcomes the elimination of any sense of boundaries between art and science, and suggests the growth of interest in collaborations could correspond with the growth of research into genetics. "The profound effects of being able to cut and splice genes from different species" are stimulating "urgency". Clancy attributes the spread of interest in these developments in part to the publicity
surrounding Kac's *Alba*, and says she would not be surprised if there are 'green rabbits' in many laboratories around the world. Environmental concerns are another stimulus for the increased attention to scientific research projects, she claims. To support her statement, Clancy discusses a television documentary about bio-mimicry. The programme examines industry's research into products such as tyres, and the dangerous problem caused at the edges of tyres where rubber meets metal, if that meeting is not gradual. The scientists involved in this research are studying the prospects for materials that are produced naturally, in this case abalone shells which are "really, really tough". Clancy explains that to produce tough materials in industry requires a bake process and intense heating which is very detrimental to the environment. According to Clancy, the programme talked about the benefits of realizing that we can learn a lot from nature and that we are not separated from it." The programme's focus on industry and the "growing" of products, "semi-living" products, causes Clancy to see a connection with the practices of Catts and Zurr.

In another example, Clancy suggests that humans are now "trying to link themselves with the rest of nature for environmental reasons because it feels as if we are on the edge of something - a huge disaster or a turning point". In her view, "there is a lot more environmental work now that is gentler, and more observing and reflecting of nature. That's the way it should be." Clancy points to some instances in car crashes now where, depending on the critical levels in the accident victim, instead of operating immediately, the victim is wrapped up and treated with a highly controlled cooling down intervention to allow the body's natural healing powers to work for up to three days before surgery. This process is adopted because, in some instances, immediate surgery could block the natural clotting process for internal bleeding, et cetera, she explains, and adds: "Hopefully in the future there is more respect for nature and that we [human beings] are considered part of nature and not separated from it."

Clancy discovered during her residency in the laboratory at MCRI that there was an expectation in some quarters that she could "help the public learn about what scientists are doing". In her view, artists do not need to be a link between the scientists and the public. However, she thinks that there are a lot of "unknown truths ... that the mass media sensationalises a great deal of scientific data,
and that a lot of scientific data and advances are not known about until they are already resolved." In light of these attitudes, Clancy maintains that there is "a misunderstanding between what artists actually do and what they can do". She reiterates that artists and scientists work in different ways: a scientist has to have an hypothesis, to work on "so-called facts", and to have proven data; an artist, using herself as an example, looks for the possibilities that arrive during the research. The MCRI scientists welcomed Clancy as an artist in residence, and were interested in her work, and her conceptual and practical processes. When they asked her for the hypothesis upon which her project was based, she explained that, although she had "concrete ideas for a new work" at the commencement of her time at MCRI, she was "also happy for the ideas to evolve during the residency". The fact that she was asked for her hypothesis underlined for her the difference between working in a laboratory surrounded by scientists, and working at SymbioticA, where artists and scientists combine. "Perhaps artists can raise awareness in different ways – you can't quantify it and you can't control it", she muses. Clancy's notion of the potential inherent in "possibilities" provides a link with the idea of the 'discards', discussed in Chapter 11.

Due to the proliferation of information via new technologies, such as the internet and mass media, Clancy believes that "artists have become more aware of what is happening in other fields, including scientific concepts and ideas, and are now more interested in working with scientists." She mentions the "big developments in science, in knowledge, and in technology since the industrial revolution" and proposes that "science has become something of a new religion, or a way of understanding the world". Bohm (1990) has a similar appreciation, albeit from the angle of truth. His attitude is that science is regarded as searching for "a unique truth", and in this it has taken over the role of religion which formerly was seen as "giving us truth" (1990, p. 26).

Maslow (1966) uses the term 'religion' in connection with science but comes from a different perspective. He agrees that scientists can have a 'religious' encounter but it derives from a scientist's experience of beauty in a scientific context.

Science at its highest level is ultimately the organization of, the systematic pursuit of, and the enjoyment of wonder, awe, and
mystery.... Not only does science begin in wonder; it also ends in wonder. (Maslow, 1966, p. 151)

Clancy’s experience as artist in residence at both the MCRI and SymbioticA enhance her understanding of the cultural differences between the disciplines of art and science. She notes that scientists are usually required to focus on, or to specialise in, one area of research, whereas artists are inclined to draw from a variety of sources, such as mythology or science. Clancy recommends Strange and Charmed9 as an introduction to the work of artists who are developing an interest in scientific developments, but reports that a friend to whom she lent the book returned it with the comment that “it was too heavy to read”. This reaction reflects an attitude Clancy has encountered from other acquaintances who have said to her that “science is really heavy”.

Edmondston takes up the concern with communication. Her particular area of interest is the “entire concept of scientific literacy and trying to develop a community that is aware and understands specific technologies and applications of science.” She sees science and art collaborations as a “platform for science communication and research.” In accord with McLachlan, Edmondston predicts that the main difficulty in putting art and science together could arise if the collaborators have “different preconceived ideas” about what they want the project to be, and what outcomes they hope to achieve. From Edmondston’s perspective, artists are interested in collaborating with scientists in order to reach a different audience, to gain creative inspiration, and to expand their experience. Another motivating factor Edmondston locates is the availability of funding that allows the scientists and artists to meet their common goals.

Scientists such as Long, who work in areas that lend themselves to graphic depiction, such as palaeontology and botany, liaise closely with artists. He suggests that these close interactions are “vital to capture the public’s imagination and, as a by-product, to raise public interest and get funding to have good artists working with scientists”. Another benefit he identifies is that artists have the skills to develop useful artistic depictions of scientific concepts that are very difficult to explain. Long’s discipline highlights the need for forms of illustrative art, although, in contrast, some branches of other sci-art collaborations regard illustrative art dismissively.
In 2000, National Science Week, established to communicate the message of science to the community, provided Long with the opportunity to organise an art and science exhibition at the Western Australian Museum. He believes the exhibition had a double impact: the promotion for National Science Week; and the promotion of approximately thirty local artists, some of whom had not been involved previously in a major exhibition. On a daily basis, Long’s experience is that art and science collaborations derive from research that “goes on when something important is discovered”. If the Museum’s depiction of the scientific material is not adequate to capture the public imagination, a professional artist is employed to assist in this work. For example, Brian Choo has reconstructed pre-historic landscapes, Martin Thompson has created a model of thylacoleo, and Tony Windberg has illustrated a book for the Museum.

Meikle suggests that a heightened public interest in and awareness of science is one social factor that might have influenced the instigation of collaborative exhibitions. Visual images of Jupiter, the Voyager exploration, Mars, and DNA, as well as computer animations of other data, have all contributed to the way in which science has captured the imagination of the public, he explains. In addition, Meikle suggests a political imperative in initiating collaborations. He avers that the scientific community is conscious of the fact that, “over the last ten or fifteen years, most of the government funded granting bodies have begun explicitly calling for collaborative type projects, cross discipline projects, and multi-institution type projects.” He notes a parallel here between art, science and literature and “a universal trend towards the breaking down of disciplinary boundaries”. He says another reason that could influence the government’s attitude towards funding is that perhaps it perceives collaborative projects as “value for taxpayers’ money because different disciplines and institutions work together”. Meikle’s observations fit with Rowley’s comments above.

McLachlan queries the veracity of the preamble to Question 3, which suggests that the general public is sceptical about recent scientific developments, and claims there is “a high degree of public acceptance for science”. He lays the responsibility for “a cultural paradigm which has a difficulty with science” at the feet of cultural leaders, governments, and journalists who are predominantly arts graduates with little understanding of science. Doherty (1997) has similar views as
McLachlan maintains that it is the "opinion forming avant-garde that is sceptical about science rather than necessarily the general public as a whole." Much of this scepticism and fear arises from the potential applications of new technologies, which, at times, are perceived as potentially dangerous or as having politically motivated functions to limit personal 'freedom'.

McLachlan distinguishes "two very simplistic ideas" about why artists and scientists choose to collaborate: "one of how science helps art, and the other of how art helps science." The first is that the scientist supplies the artist with "pretty pictures" for the artist to convert into an art work, a process that can be interesting, but is "intellectually unexciting", according to McLachlan. The second, "and most tedious of the agendas", is that the artist assists the scientist to explain the science to the public. To move away from these simplistic programmes, McLachlan advocates that artists move to new media, and mentions SymbioticA as a model. The invention of a new medium frequently signals a burst of creativity, says McLachlan, and artists who "want to learn something that is completely novel" are interested in collaborating with scientists.

McLachlan identifies "the possibility that the artist can make the scientist more creative" as of benefit to scientists. He submits that he and Storey used conversation as probably their "main research tool". Scientists can respond easily to questions such as "How does that work?" McLachlan recognises that it is more difficult to explain "the problems within a pretty picture and to look for the discarded things". In fact, Storey and McLachlan developed their collaboration through a "look for the discarded things". This occurred when, in conversation, Storey raised the perception that biology is deterministic, a view McLachlan says is popular due to the Human Genome Project and the notion that genes "tell you everything about organisms". He explained to Storey that this was not necessarily the case. A significant course of events ensued.

McLachlan gave Storey examples of "things" that were not deterministic and she then asked for an example of something that was completely deterministic. He used sex determination in mammals as an example.

I said "everybody knows that you have a Y chromosome in mammals and that makes you male, and on the Y chromosome there is one gene, called SRY, which is the determining feature,
and that one gene will actually initiate the cascade, so that is highly deterministic." Storey asked "is that really true?" I went "mmmm". There are a couple of discarded bits of information involved and that is where we developed the joke about rubbish being thrown away, the discarded bits of information, and that is what led to the paper in the *Journal of Theoretical Biology* (JTB). (McLachlan)

The collaborative paper in JTB was noticed by *Nature* which ran a news story about it. McLachlan highlights the irony of the situation in that, as a developmental and molecular biologist, none of his papers had attracted the attention of *Nature*, but a collaborative paper which grew out of his desire for a change, to do something without any "pay-off", to do something that was "fun", actually generated a high level publication. Eventually, the project received £370,000 in external funding. This figure exceeded any single grant that McLachlan had received from the Medical Research Council or any other funding body.

McLachlan is hopeful that, if other scientists realise what is possible, it could encourage them to work closely with artists and to seize the opportunity to pursue a project that is "really interesting instead of something that is really focused". Due to the clear definition by most sponsors of the "kinds of things that you are allowed to work on", McLachlan claims there are a lot of "bored scientists, and bored scientists are rarely good scientists, and, therefore, they are looking for something that really engages their imagination."

A superb storyteller, McLachlan relates the tale of Richard Feynman and his appointment to the California Institute of Technology. A rising star in physics, Feynman arrived full of promise but became stressed when he could not decide on a research project. His main comfort was that he was a "terrific" teacher and found teaching really satisfying and enjoyable. According to McLachlan, Feynman "had an epiphan, a moment of inspiration". First, Feynman came to the wonderful realisation that: "If I'm not a good scientist, they made a mistake". They had appointed him as a star; he was not a star. He felt absolved; it was not his fault. One day he was in the canteen and saw someone spinning plates on a stick. He thought "That's really interesting; I wonder what the physics of that are". As McLachlan points out, "of course, it is dynamics, something that had been done a hundred years ago so you might think it is not interesting as a
research topic, but, you guess the sequel, that became the research that won Feynman the Nobel Prize."

McLachlan emphasises: "this new way of thinking about things actually gave him a real insight into something creative. So the sense of fun there comes across really strongly, and I think that, for scientists, normal science is often not fun." To support his assertion, McLachlan describes as "incredible excitement" the emotion that scientists feel when the moment arrives that they are the first person to know something, to understand something nobody has ever understood before, a moment hoped for during long arduous hours of research. This is the instance many commentators describe as the 'aha' [or ah ha!] moment. As Turney (2003) reports from his interviews with ten scientists, two common factors prevailed: the first is the need for a scientist to have a "strong personality to overcome the fear of failure which is bound to haunt anyone trying to discover something new", and the second is the agreement that the 'Eureka' or 'aha' moment, "when you know you have glimpsed something hitherto unseen by anyone", is beyond compare (2003, p. 14).

Piccinini, and Wallworth, (a non-participant), are two artists whose art work relates to biologically based matters but who affirm that they do not collaborate with scientists. Piccinini believes that an artist does not necessarily need to be a scientist to comment on that area. In some ways, for her, to have a space between the artist and the scientist can be an advantage. However, Piccinini points out that art that is solely about the technology is illustration, as are the colourful photographs of scientific material.

Lynette Wallworth declares that, partly because of the wide differences in scientific opinions on issues, she does not need to collaborate with scientists, but participates in "incredible, and often intense, conversations" with them. She claims that, with scientists, "I am dealing with someone whose sense of time is very different from my own". Her interaction also allows her to speak with scientists from different disciplines who, she explains "because of the way science operates ... may never speak to one another, but my freedom is that I can bring those things together" (cited in Mackenzie, 2004a).
However, Wallworth, who thinks being an artist provides "an incredible passport to talk to a lot of people", confirms that her experience in interacting with scientists is that "they are quite phenomenally open" and that she is "interested in how forms of knowledge might run side by side that are possibly trying to look at similar things" (Mackenzie, 2004a). To me this is an indication that Wallworth is in tune with the scientists who suggest artists have a role in looking at the 'things that are lost in-between' (see Chapter 11). Wallworth has arranged several interdisciplinary 'interactions' for the duration of her two-year Australia Council New Media Arts Fellowship which commenced in 2004. Her work, Hold, was exhibited at ACMI, in 2004, and at the Art Gallery of NSW in 2001. In Hold, Wallworth projects images of the night sky and the underwater environment, created by telescopes and microscopes, on to small bowls that the audience can carry and pass on to the next viewer (absolutearts.com, 2001, August 18).

Castleden has not collaborated with a scientist, nor does her art focus on biological references, but she is aware of SymbioticA through attending exhibitions such as BEAP. However, as she lectures at Curtin University of Technology, in whose gallery BEAP was staged, Castleden is conscious of the interaction between large resource centres, institutions, universities and artists which such a comprehensive endeavour necessitates. In keeping with Castleden's concept that "art ploughs a wake simultaneously to other kinds of movements and other world events", she feels it is natural that art is involved with new scientific technologies.

Although Barrow (1995) observes that "science and art have diverged" (p. vii), his book concludes with the thought that science and art could well meet in their examination of "the mind's most artful inventions" (p. 246). His views are similar to those of Castleden.

Science and art are two things most uniquely human. They witness to a desire to see beyond the seen. They display the crowning successes of the objective and subjective views of the world. But while they spring from a shared source - the careful observation of things - they evoke different theories about the world: what it means, what its inner connections truly are, and what we should judge as important. (Barrow, 1995, p. vii)

In addition to being a major sponsor of sci-art, the Welcome Trust also publishes books in the field. However, Quin (2004) is sardonic in his review of a
recent publication, Experiment: Conversations in Art and Science in which Arends and Thackara (2003, p. 66) state that Lyotard and Foucault “have spoken of 'transdisciplinarity' as a means of achieving new forms of knowledge” and, in a footnote, direct readers to an essay by Jan Verwoert. Quin classes Foucault’s use of the term ‘transdisciplinarity’, and his notion that such activity will “create new knowledge that is unattainable by pure art or scientific practice”, as “one of the last touchstones of modernist optimism”. Quin finds little to enthuse about in the book and concludes “Sadly, it seems that for much of our uncertain times the conversation between art and science remains a dumbshow” (2004, p. 144). In my view, the book provides a visually exciting catalogue of projects funded through the sci-art programme Consortium during 2000-2002. However, probably due to its genesis, the publication does not comprise an intellectual debate about the relevance of sci-art and this was possibly not intended. In light of some of the opinions expressed by my participants in relation to the nature of various sci-art collaborations, some of the book’s examples appear to be ‘soft’ science that flirt with illustration.

Is science appropriating art?

Times may have changed but Waddington (1969) suggests that illustration of scientific concepts is not the domain of the serious artist and that the scientist looks to the artist for “the enrichment and deepening of his [sic, the scientist’s] consciousness”. He claims that this faculty will be found in a “painter in whom the climate of scientific thought has penetrated into the spirit” (1969, p. 155).

Root-Bernstein (2004) offers a comprehensive but concise picture of the current association between scientist and artist. He surmises that one reason some people fail to see the connection between art and science is that they take on board Snow’s concept “that artists and scientists were members of non-communicating, antithetical endeavours”, without understanding that Snow viewed such a situation as “intolerable and inexcusable” (p. 93). Snow’s ‘two cultures’ is frequently alluded to in sci-art texts, but, in his Rede lecture, Snow related to the arts and, in particular, the gap between literary intellectuals and scientists, a point not lost on Ward in his review of conVerge: Where Art and Science Meet. “But, alas, it has to be said that when science and art converge it’s not inevitably to the advantage of the former or to the spiritual extension of the latter. Banal outcomes can occur” (Ward, 2002, p. R21).
The fact that two Nobel laureates, in 1980, could believe "that the arts had not contributed anything of value to science since the Renaissance", concerns Root-Bernstein, and he lists artists whose work has impacted on science, and techniques pioneered by artists and adopted by science, such as anamorphic distortion (from painting), false colouring (Fauvism), and pixelisation (Pointillism). Root-Bernstein ponders whether the Nobel laureates' position derived from a lack of knowledge or thought, "Or do scientists, wittingly or unwittingly, dismiss artistic contributions in order to objectify their results?" (2004, p. 93). His suggestion correlates with Bunt's assertion below that involvement in a sci-art collaboration is not necessarily an advantage, career-wise, for a scientist.

Root-Bernstein (2004) develops an argument that, in accord with Kenneth Clark's observed "epiphenomenon", artists and scientists draw on similar mental capabilities. "The majority of successful scientists have been amateur - and sometimes even professional - artists, musicians, composers, poets, playwrights and novelists who have understood the value of arts for scientific education, thinking and creativity", claims Root-Bernstein. As examples he cites, among others: Desmond Morris, "Oxford zoologist" and "professional surrealist painter"; and Roger Penrose, "the Cambridge physicist whose tessellations have transcended even Escher's" (2004, p. 93).

The average scientist, in contrast, is unlikely to have artistic hobbies and far more likely to dismiss the arts as uninteresting or even antithetical to science. Because the scientific enterprise has been growing so rapidly the philistines dominate the culture of science. (Root-Bernstein, 2004, p. 94)

Root-Bernstein grounds his argument on a study based on interviews with forty scientists about art, science, and the notion of the two cultures. Nevertheless, the sting in the tail of Root-Bernstein's article involves his question as to whether science itself can survive the increasing marginalization of the arts both within society and within science itself, especially if the best science is done by polymath individuals who integrate the two. Conversely, we must consider what the impact on art may be if scientific inputs become increasingly rare. (Root-Bernstein, 2004, p. 94)
As an example, Bunt mentions the situation in which a photographic equipment company advertises a competition for the best photographs of cells. This competition would not represent an appropriation of art, he says, as the majority of participants would, in all probability, be scientific photographers or scientists who feel creative, and would not be full-time practising visual artists. According to Bunt, in this instance, the photographs produced would qualify as illustration and not sci-art, a view shared by several of the participants.

An inconsistency that develops from an artist and scientist collaboration, suggests Bunt, is that the artist’s professional reputation is enhanced by exhibits of, and publications about, the resultant art work, but involvement in an art exhibition does not necessarily enhance the career of a scientist and, in some instances, may be regarded negatively. In this Bunt replicates the observation of Pearce et al (2003) that “scientists do not get tenure points for being in art exhibits any more than artists gain value by working on scientific research” (p. 125). Bunt’s hypothesis is borne out by comments from some scientists at MIT, USA, who, when asked about the presence of Joe Davis in the laboratories, commented that Davis treated the area “like a playground” and that his work should be “evaluated with the same scrutiny as the scientific output of the postdocs”. With funding tight, there are few opportunities for artists in laboratories. One scientist, who at first intimated that he would accept one of Davis’ artist “recruits” but eventually withdrew the offer, told Nadis that “as a junior faculty member, that’s not the sort of thing that will help me get funded or tenured. When I’m as established as Alex Rich, it might be a possibility” (Nadis, 2000, p. 670). In 2000, Catts and Zurr received a one year fellowship as artists-in-residence at Joseph Vacanti’s tissue engineering laboratory at the Massachusetts General Hospital. After early scepticism, Vacanti said that his colleagues became enthusiastic about the artists’ presence. Nadis interviewed Catts and reports that the latter’s view is that artists need to engage with and comment upon the world around them.

That world should include science and technology — and biological research in particular — which are emerging as key driving forces behind the development of twenty-first-century society. We can’t go
on painting landscapes forever, as if nothing has changed [italics added]. (Cuts cited in Nadis, 2000, p. 670)

Bunt notes that one scenario that impacts on the scientist involves the arrival of an artist from a humanities background into the laboratory with an idea or concept that forms the basis of the collaboration, but with no training in biology. Although the artist is very welcome, the scientist could become an "expensive, highly skilled, technician for the artist", and the collaboration then demands a disproportionate amount of time and effort from the scientist. Bunt intimates that most scientists find the interaction enjoyable but that their rewards are intangible: for example, inspiration to think of new ideas; to think of their work in different ways; and to experience a change from customary practice. McLachlan has similar comments. Other mutual intangible benefits that Bunt proposes accrue from the interaction include the development of respect for the other's discipline and professionalism, and the "debunking" of myths such as "scientists are looney, amoral vivisectors", and that "all artists are crazy do-nothings".

Cleworth's perception is that it is artists who are "using science to legitimise their work as being cutting edge and current" and he questions whether "scientists are really that interested in the visual arts" as a collaborative process. He cites Laurie Anderson's connection with NASA as a prime example of an organisation possibly exploiting the services of an artist but, for Cleworth, Anderson's position is not "much different from an organisation buying art work to exhibit to enhance its public image". At a seminar, Redefining Parameters, at the Western Australian Museum in Perth, February 12, 2003, Anderson was asked what NASA was "getting out" of her. She replied that she had not thought about it in those terms but that she thought NASA "found it refreshing to have an artist" involved. She pointed out that NASA has a large art collection and that they commission art work (L. Anderson, personal communication, February 12, 2003). According to Hull (2004), NASA has commissioned work by 250 artists since 1963, but its expenditure is dependant on budgetary parameters. In 2004 NASA's art expenditure was US$50,000 of a total US$13 billion budget. Since the seminar in Perth, Laurie Anderson has received a US$20,000 commission from NASA with total creative freedom. "She intends to produce a range of works from her two-year
NASA commission, including a film on the moons of the solar system that will debut at the 2005 World Exposition in Japan” (Hull, 2004, p. A19).

Although some seminar attendees viewed Anderson’s co-option by NASA as an expedient means of rebuilding the organisation’s public image after the tragedy caused by faulty tiles on the space shuttle Columbia, in 2003, Benjamin looks for the positives in the association. He suggests that, provided Anderson is well remunerated for her input, he is pleased that artists are paid for their contribution. In addition, as an artist, he hopes that Anderson’s involvement is a way of stimulating a different way of thinking that could provoke different outcomes. However, he questions government spending in areas such as arms when more basic causes are in need of funding.

Edmondston deems the artist and scientist collaboration a difficult one and questions whether the scientists “are really getting something out of it.” However, her view is that “if it is an art and science communication project, then I think that is entirely different because it can establish a platform for discussion of different technologies.” Her concern is that artists or scientists could enter collaborations with the intention of generating an outcome that prompts acceptance of a scientific development, whereas Edmondston, from a science communication perspective, does not necessarily want people to be more accepting of the scientific developments, but I want the public to be able to make decisions based on an understanding and awareness of these developments. I think some people will do a sci-art collaboration as a means of increasing awareness of a particular technology, so that the public will feel wonderful about taking it up, or supporting it. I’m not sure that that is what their aim should be. (Edmondston).

Edmondston does not detect a strong link between sci-art and the advancement of science research because frequently the science involved is the “softer” science. However, she suggests a more likely connection is that the artists achieve their goals and the scientists achieve funding for more work and a higher profile because of the art collaboration, (a point Bunt would question, see above), or increase scientific literacy based on the message inherent in the art work. The latter is problematic, according to Edmondston, because much sci-art is controversial and
comes laden with a message, but, if that message is the preferred one, then the collaboration has achieved its goal. Kac’s fluorescent rabbit is an example of a collaboration which has resulted in conflict between an artist and, in Kac’s case, the French government. Hesse-Honegger’s situation is similar, as described in Chapter 11.

Edmondston conjectures that artists are sometimes thought of as being freer of constraints than scientists and that this could lead to a good collaboration: it could be possible to legitimise more freedom in the science response if the project were an art work and not a publication relating to that particular area of science. Kurz’s controversial experience with the FBI challenges the notion of wider freedom for artists, particularly since the tightening of security following the terrorist attacks on September 11, 2001 (see Chapter 11).

Reflecting on Edmondston’s comment regarding the possible raised profile of a scientist following a sci-art collaboration, I mentioned to her that a previous interviewee had suggested that such a collaboration could be detrimental to the scientist’s career. Edmondston agreed. She elaborates that scientists could distance themselves from the work by saying “I provided this information and this is what the artist did with it”, but it depends from which source the scientist is “looking for recognition”. When artists and scientists court the media and develop a high profile, the resulting “limelight” for the scientist can sometimes mean that their scientific integrity is questioned. Nevertheless, Edmondston proposes that some scientists could see a sci-art collaboration as a different avenue for obtaining research grants.

Castleden was surprised by the question about science appropriating art and did not think that scientists would necessarily engage with art for that purpose. However, the question prompted a recollection of a lecture, presented by a surgeon, that she had attended, titled Art, Medicine and the Body, which included a slide presentation of images of cancer cells juxtaposed with beautiful landscapes of Western Australia. The similarity of colours, shapes and forms bridged the boundary between medicine and art but the actuality of the content of the slides was very different. Castleden considers this an interesting way for a scientist or a medical person to be receptive to the visual language of an artist. Her story reflects Root-Bernstein’s theory regarding polymathia mentioned earlier.
In line with his comments that scientists do not communicate well, and do not take advantage of the new media to explain their difficult concepts, such as stem cell technology, Meikle claims that "maybe scientists should be appropriating art more, or perhaps collaborating with artists more often, to try to explain some of these difficult concepts and to provoke debate." Paradoxically, Quin (2004) recalls the performance piece by Joseph Beuys, *How to Explain Pictures to a Dead Hare*, which he presumes was intended to emphasise the "almost inevitable communication breakdown when artists try to explicate their work" (2004).

McLachlan has reservations about the use of the term 'science' in Question 4 and prefers the term 'the establishment of science'. In addition, he prefers to say 'men and women working in science' rather than 'scientist'. To answer the question then, McLachlan replies that "the men and women working in science are not appropriating art at all". Nevertheless, he conjectures that the appropriation of art could be a public policy agenda, but not the intention of scientists, whom McLachlan suggests have "anti-authoritarian" tendencies. Here McLachlan arrives at an interesting theory of a tension between science and medicine, because he locates medicine as authoritarian and claims that science and medicine do not overlap comfortably, the two training protocols being "antithetical". This leads him to speculate how this dynamic would affect the way in which science, medicine and art could fit together.

Nicholls, who recognises the need for better communication of scientific work, advocates that scientists should appropriate art to help them in this area. However, she nominates astronomy, chaos theory, and fractal geometry, all areas where the data generate "fascinating diagrams" and "pretty pictures", as scientific fields with better communication outcomes. The Human Genome Project has also stimulated public interest, according to Nicholls. She says that it is "amazing how little people know about their bodies", and, analogous to that, although people use digital technology, "very few would be able to defend the science behind it".

Kuhaupt, whilst claiming to be speaking sceptically, says he believes scientists feel "cut-off from the general mainstream opinion" and that they see artists as mediators. He argues that scientists collaborate with artists as a way of illustrating their ideas, and he doubts that they regard artists as genuine collaborators. According to Kuhaupt, because of the contemporary trend toward specialisation,
scientists in collaborations consider that they attend to the science and the artist is there to illustrate the science. His experience with engineers has been that they regard artists as "being off the planet. They just don't understand what we are doing at all." However, he puts their attitude down to the fact that they do not really want to understand artists - each has his/her own specialisation.

Summary

The participants stretch the canvas to cover a broad range of issues and responses in this chapter, a situation that underlines the necessity for a non-linear approach in this research. Ten participants regard the perceived lack of communication skills among many scientists as an important issue and as an impetus behind the interaction between art and science. Some think that a few scientists could be appropriating art to fulfil a communication function for them, and that, if scientists are not doing so already, they would be wise to consider this course of action. The problem here is that frequently the products of such liaisons are described disparagingly as being illustration and not 'good' sci-art, or as deriving from 'soft' science, products that support Wolpert's (2002) claim that merging art and science trivialises both disciplines. Nevertheless, scientific visualisation is a rapidly expanding field, particularly in areas such as space exploration, fractal geometry and chaos theory. In particular, digitally enhanced images of data made available by satellite missions provide scientists with the opportunity to communicate the results of their space research to the general public in the form of beautiful representations that are not difficult to interpret.

One scientist participant articulates the view that both art and sci-art are seen by some as irrelevant if they fail to engage in debates about new scientific and technological developments. Artists with professional practices have commented on social, cultural and, in some cases, scientific issues for centuries and many contemporary artists relish the opportunities their art provides to continue this tradition.

The Australian Government's funding policy also encourages collaborative engagements. According to some representatives, the government agenda is to promote partnerships and linkages between disciplines to assist in the interpretation of science for the public, and to foster innovation and commercialisation. In the
United Kingdom, the NIMR favours discussion, integration and process rather than superficiality and the end product. These multilayered stances are typical of the complex relationships that can develop when the parties have different, but not necessarily conflicting, agendas. Alvesson and Sköldberg (2000, p. 138) write of the tensions between "realised practices", alternative outlooks, and the possibility of being caught up in established institutional frameworks.

Formal arrangements between the parties are advisable in sci-art collaborations when funding is involved, suggests Edmondston and other participants. They point out that it is essential for both the scientist and the artist to agree on the projected course and outcome of the project at the outset, and to liaise when variations occur. They advise all parties entering into collaborations to ensure that the legal and ethical matters are carefully canvassed and resolved before proceeding with the work. These issues include copyright, intellectual property, and any possible commercial outcome.

According to the participants, there are several reasons to initiate sci-art collaborations, including the intellectually and aesthetically exciting possibilities the new techniques and materials offer. Importantly, access to innovative resources has frequently heralded a burst of new activity. The idea that new materials and new methodologies derived from technological and scientific developments both threaten and invigorate contemporary art practices leads me to hypothesise that this tension would provide stimulating opportunities for artists. The possible outcome, that it would move art practices to a new dimension, sits within a triadic dialectical framework usually ascribed to Hegel.

Another reason proposed for the interest in sci-art is that, although scientific research, such as the human genome project, is topical, there is, purportedly, scepticism about the technological and medical developments prevalent in the community. The participants sense that, as well as characteristics such as excitement, repulsion, attraction, fascination and challenge, artists view the opportunity for a sci-art collaboration as a means of examining and critiquing the latest research outcomes, and scientists view collaborations as a means of explaining and presenting the outcomes to the public. However, not everyone agrees that sci-art collaborations are worthwhile.
Although some intangible benefits may accrue to scientists from sci-art collaborations, and the movement of science into other fields could contribute to its power within the culture, according to Mukerji (1994), a scientist's career is not necessarily enhanced by the project. It is suggested that scientists could benefit from the prospective freedom artists are supposed to enjoy and feel less constrained within a sci-art relationship, and that some artists could interact with scientists in the expectation that the results will be deemed 'cutting edge'. Although the presence of artists in the laboratory is not universally welcomed, some interactions have resulted in attitudinal change and a greater appreciation of the benefits the two disciplines can offer each other. This could well represent another example of what Bukharin terms a dialectical disruption of an unstable harmony which is then restored, as discussed in Solomon (1973) and Chapter 4.

Finally, some exciting prospects have become apparent to me in this chapter. The first prospect is the positive attitude towards polymaths and the related advocacy for an interdisciplinary education and the redress of the marginalisation of the arts. Scientists who are proficient in an area of the arts rate highly in the 'successful' scientist stakes, it is claimed. The second prospect is the opportunity to explore new approaches, the innovative and challenging aspects of this mind-set, and the potential amelioration of the plight of the 'bored scientist'. The third prospect is the potential for art as an interdisciplinary education tool. The fourth prospect surfaces in other chapters, too. It is the notion that artists would profit from investigating the 'discards', or 'possibilities', that exist in the nooks and crannies of ideas that others have overlooked. This heralds an area of great creative potential, both practically and intellectually.
Endnotes

1 Information available in the NIMRart Research Residency Scheme information sheet current in September, 2004.

2 The failure to observe copyright and royalty requirements is also of major concern to musicians, and film and video makers.

3 Maynard Olson, is Professor of Genome Sciences and of Medicine, Adjunct Professor of Computer Science & Engineering, at the University of Washington. The excerpt comes from his keynote address to the Gene(sis) Forum at the time of the Gene(sis) exhibition which opened at the Henry Art Gallery, Seattle, April 06, 2002.

4 J.D. Watson and F.H.C. Crick published their paper “A structure for Deoxyribose Nucleic Acid, in Nature, April 25, 1953. The paper included the diagrammatic figure of DNA.

5 Anne Piper: Light on a Dark Lady; Ann Sayre, Rosalind Franklin and DNA (1975); Brenda Maddox: Rosalind Franklin: the Dark Lady of DNA (2002); and Hilary Rose: Love, Power & Knowledge: Towards a Feminist Transformation of the Sciences (1994).

6 The Gene(sis) exhibition travelled from Seattle to Berkeley, Minneapolis, and Evanston between 2002 and November 2004. Robin Held was the Exhibition Curator, and Assistant Curator at the Henry Art Gallery.

7 Gluttony, 2001, cast from ground marble crystal cast with a polymer binder, represents a grotesque, obese laboratory experiment mouse. Crockett’s exhibition “Cultureft”, 2002, includes Gluttony, Lust, Sloth, Greed, Anger, Pride and Envy (Gladman, 2002).

8 Wolpert is referring to Head On: Art with the Brain in Mind, an exhibition held at the Science Museum, London, March to July, 2002, organized by the Wellcome Trust.

9 Maurice Jacob is a former head of the CERN laboratory’s theory division.

10 CERN, the Conseil Européen pour la Recherche Nucléaire, (the European Organization for Nuclear Research), is located in Geneva.

11 The London Institute is the “world’s largest college of art, design and communication”, according to Edwin Catledge, the News Editor of Physics World.


13 Hans Arkeveld was awarded the Prime Minister’s Medal for his contribution to Art and Science in 2003, and the Chancellor’s Medal, School of Anatomy, UWA, in 2000. He has had many exhibitions and three retrospectives of his sculptures, prints and drawings. Arkeveld also exhibited in the “BEAP
BioDifference” exhibition, 2004, in Perth, where his work involved trials in growing living materials on moulds from various substances.

14 The BRIDGES Consortium was co-founded in 2001, by Celia Pearce and Sara Diamond, of the University of Southern California (USA) and the Banff Centre New Media Institute (Canada), to create a network for the development and dissemination of strategies to improve and support the practice of interdisciplinary collaboration in the arts, sciences, culture and technology. (Pearce, C., Diamond, S., & Beam, M. (2003). Bridges 1: Interdisciplinary collaboration as practice. Leonardo, 36(2), 123-128.

15 Circa 1990, Joe Davis, artist, persisted and talked his way into a research affiliate position in Alexander Rich’s laboratory at MIT, USA. “Davis, one of a handful of artists using the tools of cell and molecular biology in their work, is the leader of an emerging ‘new Boston school’ of bioartists” (Nadis, 2000, p. 668).

16 Adam Zaretsky’s persistence also bore fruit when, after completing his MA, and with Davis’ help, he obtained a place in the laboratory of Arnold Demain, MIT, USA.

17 ‘A fashion collection chronicling human embryonic development’, Primitive Streak, 1997, one of the first collaborative Science-Art projects sponsored by the Wellcome Trust, aimed to ‘avoid didactic approaches to communicating science’ and for the artist and scientist ‘to jointly create new objects inspired by science, but offering new perspectives and reaching novel audiences.’ The collaboration produced ‘a series of designs that elucidate 10 key events spanning the first 1,000 hours of embryonic life.’ (Information from promotional material published by the Dundee Contemporary Arts Centre, April, 2002: http://www.scienceyear.com/about_swe/events/storeys_sisters.html, accessed August 05, 2003.) The collection of dresses reflects on the first 1,000 hours of human life, and the ways in which genes influence early embryonic development.

18 The ear was sculpted with degradable polymers, seeded with human cartilage cells and inserted under the skin of the mouse following the collaborative work of Dr Joseph Vacanti and Dr Robert Langer.


20 Wallworth has arranged residencies at the Lode Star Observatory, Albuquerque, USA; the Wellesley College’s Acoustics and Physics Dept. Massachusetts, USA; the Paradise Residency, Iran; and Merrima Designs, Australia.

21 John Quin, is a consultant physician at the Royal Sussex County Hospital, Brighton, UK.


23 Bergit Arends graduated in Visual Arts Administration from the Royal College of Arts in 1997, and has extensive experiences in co-ordinating arts programmes. She is the co-ordinator of the sci-art programme and is based, part-time, at the Wellcome Trust.

CHAPTER 7

ATTITUDES TOWARDS GOVERNMENT AND CORPORATE FUNDING

Science states meanings; art expresses them. (Dewey, 1958, p. 84)

Introduction

This chapter examines the configuration of some of the major funding agencies accessible to artists, both conventional and those involved in sci-art collaborations, and, where available, it cites the aims the agencies seek to achieve. It then presents the participants' perceptions of the extent to which the receipt of funding could benefit, or have implications for, art or sci-art practices. The research questions 1 and 2 approach the subject of funding for art and science collaborations from different angles:

Question 1: What circumstances, such as social, political, economic or other, do you consider may have encouraged educational and governmental organisations to instigate collaborative exhibitions between artists and scientists, and what are the impacts and implications for artists of this institutional intervention?

Question 2: Competition for corporate research funding and sponsorship is strong. What influence do you think this situation will have on the ability of artists and scientists to retain the element of creativity necessary in explorative and interrogative practices?

Responses ranging from robust incredulity to pragmatism resulted from the comment that "generous funding allocated to these activities [art and science collaborations] has enabled artists working in the many aspects of this field to choose
a variety of responses" in the preamble to the interview questions. As some participants had no personal experience of the funding process, their comments, looking from the outside in, establish a range of views.

**Types of funding and funding organisations**

**Australia Council and Australian Research Council**

Cutler (2001) anticipated a "seamless overlap" between his interests in both the arts and industry upon his appointment as Chairman of the Australia Council in 2001. In addition to art’s importance in "expressing the soul of a community and the spiritual and intellectual journey of its citizens", art has a significant role "in scientific and technological endeavour" he explained. Cutler pointed to the importance of the Australia Council in the push towards Australia becoming a creative nation with an emphasis on innovation, and Prime Minister Hawke emphasised the need for Australia to become a 'clever' country at the opening of the National Science and Technology Centre in Canberra, in 1988.

Part of that push was the establishment of The Australia Council’s New Media Arts Board to support “arts practices that do not fall within conventional, single artform [sic] areas.” (Australia Council, 2004b). Biotechnologically based work comes within this Board’s purview. Some participants in this research have received funding from the Australia Council, and its New Media Arts Board. Piccinini received $40,000 Fellowships in 2000 and 2001, and was the Australia Council’s artist at the Venice Biennale, 2003, with all aspects of the preparation, promotion and exhibition of her work funded by the Board. Cats received $50,000 for his US residency in 2000, and SymbioticA received $37,492 in 2002, and $10,000 in 2003. Clancy received $10,000 in 2002 from the New Media Arts Board and $10,000 in 2003 from the Visual Arts/Craft Board.

The Australia Council’s emphasis on innovation, while elements such as form and concept could purportedly receive less rigorous scrutiny, is not universally endorsed. Timms (2004b) caustically advises artists who have difficulty complying with the "conceptually innovative" criteria to throw away "those stuffy old paintbrushes" and to buy “something that plugs in”. His comments add to the debate.
about the tensions between the attitudes of conventional and new media artists discussed in Chapter 6.

The Visual Arts/Craft Board has a funding category especially for the purpose [the New Media Arts Board], even though it is otherwise very keen to avoid media categorisations. Some media – painting, printmaking, drawing and the crafts – are irredeemably associated with the art of the past while others – performance, video, photography and computer technologies – definitely belong to the present moment. The use of advanced technologies is one way artists can assert their avant-garde credentials by default. These media are sexy. (Timms, 2004b, p. 19)

As noted in Chapter 1, and indicated by a recent Australia Council announcement, the areas of sci-art and new media are changing rapidly. The Australia Council’s press release, (2004a, December 08), has relevance to my previous paragraphs in connection with that body. The Council has decided to dissolve the New Media Arts Board and to create a new Inter-Arts Office with responsibility for supporting hybrid practices. The Council describes hybrid art forms as those “where artists combine conventional artforms [sic] to create new forms of artistic expression”, and these criteria would include science and art collaborations. The digital media formerly overseen by the New Media Arts Board will come under the purview of the Visual Arts/Craft Board and the Music Board. The changes come into effect for grant applications early in 2005. The Council’s moves highlight the blurring of boundaries and the adjustments society and artists face in considering what constitutes an art practice, and what constitutes the role of the artist at the beginning of the twenty-first century.

Timms’ comments indicate that he regards government funding for new media, installations and performance, as “In a purely practical sense ... a kind of welfare-state art”. He observes that, because these works are “ephemeral, unwieldy, and difficult, if not impossible, to buy and sell”, they give the illusion of being beyond the scope of the commercial market (Timms, 2004b, p. 23). Nevertheless, I suggest that the substantial prices paid recently for photographic documentation of new media work will encourage optimism that the complementary elements of these art practices can operate remuneratively in the market place. The media and the primary and secondary art markets have responded to Piccinini’s recent high profile, particularly since the Venice Biennale, 2003, with an increase in the prices paid for
her work. By 2003, her limited edition photographs sold for A$8,800 each and had trebled their 1998 price; one reached A$45,836 at auction, and, in 2004, her major sculptures and installations were selling for A$260,000.

Timms suggests that institutions have been the principal purchasers of digital work since its inception, and that Western governments generally support installation, performance and video and “pay for the public exhibition spaces that show it, the tertiary educational institutions that teach the theory in the first place, and the public museums of contemporary art that represent virtually its only buyers” (2004b, p. 24). The institutional support Timms identifies is, perhaps, obligatory for government instrumentalities as it is in line with government policies that promote innovation and creativity, policies promulgated by several Western countries including the United Kingdom, Singapore, and Australia.

In relation to new media and traditional art lobby groups, Timms identifies the proponents of “real painting” as high on numbers but low on organisation, but, in contrast, proponents of new media are “energetic, well organised, disciplined and highly effective. Importantly, they control most of the forums through which ideas are dispersed” (2004b, pp. 25-26). As Timms explains, there are differing views on the relevance of traditional art in the current new media era, but he believes the persistence of the binary opposition between the two is “about power, about the control of public institutions – specifically art schools and museums” (2004b, pp. 26-27). Several of the high profile organisations supporting biotechnologically based art are also committed to the fields of interactive immersive installations, artificial intelligence, and ‘reframing’ consciousness. One of the most dynamic organisations is the Planetary Collegium (see Chapters 1 and 4).

Since the mid-1990s, Piccinini has benefited from the Australian Government’s push for innovation and technology, and its subsequent funding for new media. Her work is representative of the early exhibitions in new media that mainly comprised artists who did not collaborate with scientists. Many of the artists whose technologically based art practices originated in Australia during that period have subsequently exhibited in the numerous international comprehensive new media exhibitions established since the mid-1990s. In addition to Federal Government support through the Australia Council, Piccinini has received funding from Arts Victoria, the Melbourne Festival, Film Victoria, and others.
The New Media Arts Board, itself developed from the initial Art and Technology Advisory sub-committee of the Australia Council, sponsors The Australian Network for Art and Technology (ANAT). In 2002-2003, that sponsorship was $275,503. ANAT provides an advocacy body and network for artists working with science and technology. As part of its support for ANAT, the Australia Council provides funding for Synapse, an online database resource designed to encourage sci-art collaborations and to facilitate connections between industry, researchers, curators, scientists and artists. In 2002-2003, the Australia Council provided $106,812 for Synapse. ANAT is also assisted by the South Australian Government through Arts SA, and the Visual Arts and Craft Strategy, an initiative of the Australian, State and Territory governments.

Another avenue pursued by the New Media Arts Board is the promotion of artist in residence programmes such as that established with the CSIRO. Snelling (2002); the New Media Arts Board Chair, states “The Board expects the outcomes of this new residency to further develop inter-disciplinary [sic] practice providing new insights that benefit both artistic and scientific endeavour”. The third recipient of the residency, Meredith Walsh, works with multimedia and is interested in the philosophy of perception. She views the residency as an opportunity to “investigate the roles of vision and touch in virtual space” (CSIRO, 2002).

Perceptions of the role of artists in the push for innovation vary. Catts recalls that, during the Australian Government’s Innovation Summit in Melbourne, in 2000, Professor Sue Rowley, Executive Director Humanities and Creative Arts at the Australian Research Council (ARC), stated that she sees “the role of artists working with new technologies as vehicles to help appropriate those technologies for the wider community”. Catts contends that this remark is insulting to artists as it infers that artists are merely illustrators of the scientific concepts and facilitators of the new technologies for the public, and that their critical input is not valued. At a Creative Arts seminar I attended in Perth, in May, 2004, Catts reminded Rowley of the comment and asked for further explanation. Although an exchange of semantics ensued, I am not convinced that a resolution satisfactory to both parties was achieved.

The ARC’s stated mission is “to advance Australia’s research excellence to be globally competitive and deliver benefits to the community” (Australian Research
Council, 2004). To further this aim, the ARC has inaugurated the ARC Research Network for Tissue Engineering: Living Materials for a Healthy Australia (ARNTE) to “bring geographically separate groups from a wide range of disciplines into a critical mass of cell and tissue engineering research”. In particular, the Network encourages linkages between “Areas as diverse as art, public awareness studies, and nanotechnology”. Its funding derives from the ARC, the National Health Medical Research Council (NHMRC), university and other government sources, and private and international sources (ARNTE, 2004).

Although the establishment of these types of linkages is welcomed by those seeking to participate in creative and innovative measures, some are concerned that the cultural benefits are not factored into the equation. The attendees at the seminar (ibid.) in Perth in 2004, including the sci-art panel, were predominantly university personnel from the humanities and science. The debate broached ways in which the Howard Australian Government could be convinced to see, not only the economic value, but also the cultural value of creative industries. The four clusters for recommendations adopted by the Innovation Summit Implementation Group for the Australian Innovation Summit, 2000, were Culture; Regulation, Finance, Measurement and Intellectual Property; Stimulating Innovation; and Linkages and Support. Bagnall (2003) refers to the European Union’s (EU) Cultural Commission’s policy paper in her concerns about the methods used to measure the performance of cultural institutions and the matter of who defines ‘value’ in this context.

The cultural sector cannot rely any more on a presumption of its worth; in future, that value will have to be monitored, tested and articulated in terms acceptable to those who are not its natural supporters, in the face of urgent and competing demands on the public purse. (cited in Bagnall, 2003, p. 76)

Australian Business Arts Foundation

The Australian Government promotes cultural philanthropy in the form of Artsupport Australia, a joint initiative of the Australia Council and the Australia Business Arts Foundation (AbaF). The Foundation offers AbaF Awards to acknowledge companies who have funded cultural activities and to encourage others to come on board. In particular, the AbaF is interested in fostering long-term
partnerships between cultural organisations and business instead of 'one-off' sponsorships.

Two leading philanthropists in this field are quoted in AbaF promotional material, one of whom is the patron, Richard Pratt AC [Companion in the Order of Australia]. "Australia's arts and cultural life is critical in helping to define who we are as a nation. Who we are and how we see ourselves matters enormously in developing our business and generating wealth [italics added], (Pratt, 2004).

Schofield (2003) observes that, in the USA, the private sector is the prime source of funding "for major performing arts companies and galleries", but cultural organisations in Australia receive "significant funds from both government and business with increasing emphasis on the latter" (p. 73).

The Wellcome Trust

The Wellcome Trust was established in Britain by private endowment through the will of Sir Henry Wellcome in 1936. Its mission is "to foster and promote research with the aim of improving human and animal health" (The Wellcome Trust, 2004). The Trust's initiatives in the sci-art field aim to assist the "cross-fertilization" of ideas: to inspire art with "science's insights into the natural world" and to offer science "an entirely new perspective on research". The aim of the Trust's sci-art funding scheme is "to encourage artists and other creative professionals to explore biomedical subjects", but the following quote suggests that the ultimate purpose is to appropriate art to the service of science. The Trust summarises its science and art agenda as follows: "More prosaically, adding an artistic dressing to scientific concepts is an effective way of making technically complex material more palatable for wide public consumption [italics added] (The Wellcome Trust, 2004).

Predictably, Landry (2000), who was one of the judges for a Wellcome Trust SCI-ART competition, applauds the Trust's role in encouraging collaborative proposals and in generating over 400 proposals over two years that promote a synthesis between scientific and artistic thinking (p. 147). In 2004, the Trust offered grants totalling £500,000 for sci-art projects associated with "biomedical science and its social contexts" (The Wellcome Trust, 2004). Nevertheless, in response to questions about the mediocrity of some sci-art collaborations, Arnold, a
representative of the Wellcome Trust, admits that some of the projects are “not very good, and predicts that art-science projects will become less popular in the future” (cited in Cartliidge, 2000).

Wolpert (2002) “completely disagrees” with the Wellcome Trust’s expenditure of “many thousands of pounds to art/science projects” and deems “bemusing” the notion that content and creative processes are similar in the visual arts and science.

Corporate funding

Corporations enjoy many benefits from their association with the arts; for instance, arts-based entertainment, assistance with marketing, and prestige in the ownership of professionally researched and managed quality art collections. As Reid (2002a) would have it, corporations would be well advised to judge art as a sound asset because “art is a large and high-growth market, characterised by transparency, liquidity and strong information flows” (p. 36). However, Reid contradicts his assertion of transparency when he notes the unscrupulous practice of renaming art works (Reid, 2002d), discussed in Chapter 4. In another article, Reid reflects on his visits to some Australian corporate collections and reports that “the [Macquarie Bank art] collection showed the role art could play in underscoring an organisation’s culture and reinforcing its marketing and image to the public” (2002b, p. 36).

Not all corporate art collections are treated with the professional care and attention required to maintain them in good order. The Fairfax corporate art collection has suffered in recent years, according to Reid. “Many paintings were hung above photocopiers, and one in a fire exit. Every time that fire exit door was opened, the handle went through a well formed hole in the canvas” (Reid, 2002c, p. 36). This damaged condition not only has implications for the value of the corporation’s asset, but, should droite-de-suite be implemented in Australia, the damage could impact detrimentally on the subsequent payment due to the artist on re-sale, depending, of course, on the conditions enshrined in the legislation.

Community acknowledgement is another area in which corporations gain recognition for an interaction with art. Sigler, Chairman and Chief Executive Officer of Champion International Corporation, confirms in an interview that
from a purely selfish point of view, this company has never received the kind of recognition for anything it's ever done at any time, as it has received and is still receiving, because of the involvement with the Whitney [Museum]. (cited in Jacobson, 1993, p. 84)

On the other hand, in keeping with its subtle approach to luxury advertising, Moët et Chandon's Australian art touring exhibition constituted a "lucrative" sponsorship for the artists selected and the company. "Exploiting the notion of art as 'high culture', Moët et Chandon has built up an association between the quality image associated with art and the image of the company's products" (O'Loughlin, 2000, p. 20).

To balance the discussion, I cite Montmann (2002) who critiques an exhibition titled Art & Economy, hosted by Siemens, in Hamburg. She identifies advantages and disadvantages in the interaction between the art works and the corporate model, but, overall, she states "business does not (yet) seem prepared for the institutional critique that museums have learned to desire" (2002, p. 187). To be fair, museums in Germany may desire critique, as she asserts, but such a generalisation leaves her argument open to question.

As a recipient of corporate sponsorship, Benjamin participated in a visit to William Creek, South Australia, by a group of ten artists financed by an Australian businessman. Benjamin states that the results of the experience and research facilitated by that journey are still informing and enriching his art practice. In return, the sponsor received a collection of art works. The expedition is featured in a book, William Creek and beyond: Australian artists explore the outback, and Benjamin regards the publication as a means of extending the "tentacles" of art into the wider community.

In relation to corporate and private patronage, one participant notes that wealthy business people sometimes endow art galleries to ensure recognition of their name in perpetuity. For example, in part to acknowledge his endowment of the Handa Classical Percussion Studio at the university in 1995, the Edith Cowan University conferred an Honorary Doctor of Letters upon Japanese philanthropist and businessman, Dr Haruhisa Handa, in 1998.

Meikle stresses that the reason competition for corporate funding is so strong is "that the funding is so pathetic; funding provided by the corporate sector is
incredibly small in Australia compared with other OECD countries". He asserts that the rankings show that Australia is in the top ten countries for government sector funding, but is outside the top one hundred for corporate sector funding.

Competition for corporate funding and sponsorship is strong, both in the arts and sciences, Bunt acknowledges, but because new technologies generally are becoming more expensive, it is financially difficult for the artist or scientist to work independently. For example, if one chooses to work with tissue culture, the requirements include biological safety laboratories and equipment valued at approximately A$50,000, and the necessary infrastructure to exhibit tissue culture based art is costly. An example is MEART, Bunt's collaborative 'semi-living artist' installation, described in Chapter 3, which was shown at PICA as part of BEAP 2002, and exhibited again in 2004: Australian Culture Now. For this later exhibition, The National Gallery of Victoria and ACMI were supported by funding from Breast & Young (principal sponsor), John McCaughey Memorial Prize Trust (exhibition partner), Sofitel, Xenon, Taylormadesigns, the Australia Council, and others. The 37 sponsors for BEAP 2004 are listed in Appendix D.

Corporate funding can also meet with controversy. This was the case in Tasmania, where Robyn Archer, curator for the Ten Days on the Island Festival 2003, and Jim Bacon, then Premier of Tasmania, defended their acceptance of $50,000 sponsorship from Forestry Tasmania, a wood-chipping entity loathed by many Tasmanians and conservationists. Schofield (2003) asserts "it was not a wise move. 'The wedding to the woodchippers' (as author Peter Timms branded it) sparked mass defection of high-profile participants' and an alternative event called Future Perfect" (Schofield, 2003, p. 72). Despite the increased competition for funding, the uproar highlights the sensitivity arts organisations need to exercise when seeking sponsorship, whether it is private, corporate or government, and "the dangers inherent in accepting cash from the unacceptable". Benjamin asks whether it behoves artists to ensure that any corporate funding they receive derives from ethical business practice. This, of course, would engender a difficult situation but nevertheless it is an interesting point when, for example, one considers the efforts of some company shareholders to influence "green" outcomes.

Due to the nature of his work, the funding for Long's projects frequently materialises in response to individual events. His research expeditions are often
unexpected and sometimes are precipitated by an exciting fossil discovery. Therefore, due to the urgency of his departure, instead of seeking funding before the project begins, often the Museum has a project that stimulates publicity and community interest, and, says Long, the funding "will come to us". Operation Leo, which involves scientific research into the Nullarbor discoveries of thylacoleo and the megafauna, is a case in point. Following the discovery, the Museum launched an expedition to the Nullarbor with no funding, but, by the time the expedition had returned to Perth, Rio Tinto had agreed to sponsor the project for three years. Because corporate funding allows the Museum to pay artists to create, display and illustrate reconstructions, Long sees the funding as generating a whole new spate of creativity that would not have been possible otherwise.

Nicholls is aware that the corporate sector has developed an increasing awareness of corporate social responsibility in the areas of community development, and sensitivity to indigenous culture. She relates the care taken to maintain the integrity of the cultural and spiritual ethos of the Aboriginal artists from the Kimberley who performed *Fire, Fire Burning Bright* for the Melbourne Festival, in 2002. Their visit was funded by the Argyle Diamond Mine. Michael Chaney, OA [Officer in the Order of Australia], Managing Director of Wesfarmers, declared at the opening of Sublime, a touring exhibition of the company’s collection of Australian art, that Wesfarmers was aware of its corporate social responsibility and planned to continue its support for the arts, and to make a meaningful cultural contribution to the community in which Wesfarmers operates (personal communication, November 19, 2004).

Chapter 2 signals warnings of possible disadvantages to those who accept funding that comes with an agenda attached. Attendees at the BRIDGES summit in 2003 noted that industrial corporations could regard collaborations as a means of "recruiting and as a way to test and promote their products" (Pearce et al., 2003, p. 127). Perhaps Sichel* expresses the nuts and bolts of the situation: "Under the banner of science, art has become a suitable channel for propagating industrial opulence and national wealth" (Sichel, 1997).

Evans (2000) scrutinises another form of corporate sponsorship. Allegedly, in 1998, Citylink donated A$100,000 to the Melbourne International Festival, "and then spent A$200,000 advertising that sponsorship.... in such a way that one could have
been forgiven for thinking that it was the Citylink International Festival.” She suggests that a genuine corporate citizen “would have donated the entire AS300,000 to the Melbourne International Festival” (p. 103).

**Research funding for scientists and artists**

Pearce, Diamond and Beam (2003) declare funding structures in the USA are “complex, tiered, overlapping, conflicting and archaic” and the competition is “intense”. They cite instances of hybridity in which artists propose projects for “science and military funding, and various forms of corporate sponsorship, including industrial R&D departments that function as art-and-technology incubators” (Pearce et al., 2003, p. 127).

In Australia, competition for all funding is “fierce”, agrees Castleden, but she concedes that there has been a large “explosion” of funding and support for new technologies. Clancy and others broach a theme I found in many of the recent publications on the lives of scientists, (see Chapter 2), and that is the large amount of time and energy researchers are required to expend in compiling research grant applications and in presenting those applications to review panels, often without success. Artists, too, are required to meet extensive criteria in their funding applications.

Bunt took strong exception to the statement about generous funding in the preamble to the research questions. He collaborates as a scientist and an artist, and has received funding for his projects through the Australia Council, ANAT and corporations. However, from his experience, he finds that it is “terribly difficult to get funding for critical and ground-breaking sci-art”. Bunt conjectures that some funding bodies are wary of sci-art projects that could be critical of developments in biotechnology, particularly if those bodies have already supported medical or scientific research in that field that could be interpreted as contentious.

Although the Tissue Culture and Art Project receives funding, Catts points out that there are many artists who do not, and, while some forms of artistic expression are supported, he, too, rejects any claim that there is generous funding for the arts in Australia.

Nevertheless, Bunt agrees that generous funding is available for two streams: one for sci-art which promotes a company’s products, and one for sci-art which
provides aesthetically pleasing pictures to decorate new institutions. Bunt is appreciative of the early funding SymbioticA received through the New Media Board of the Australia Council, and this initial assistance has enabled work from SymbioticA to be exhibited widely, in Australia and internationally. Following the publicity from these exhibitions, the scientists and artists involved with SymbioticA now receive wide recognition and this, in turn, encourages other bodies to provide funding for further ventures. In part, Bunt attributes the reluctance of funding bodies to support sci-art to the uncertainty some parties have as to which discipline it belongs: is sci-art art, or is it science, for funding purposes? Among the many issues perpetuating this divide, according to Bunt—who is quick to point out that these are sweeping statements—are the following: the art community does not consider sci-art as ‘good’ art; the art community confuses the role of sci-art, and considers it as support for the sciences; and the science community misunderstands what art is, and does not recognise the value of art.

Bunt mentions that people have questioned the source of money for sci-art in a science research department and he explains that research funding granted to the department is strictly targeted towards the research projects for which it was provided, and that the sci-art is funded separately. However, as Catts has indicated, any useful knowledge acquired during the activities of the TC&A is available to scientists. He also notes that some critics maintain that sci-art projects in a “rich” science department do not warrant funding and that there are other more appropriate areas which have a greater need of support.

Comparison of international sci-art funding

Catts is in a strong position to provide an overview of financial support for biologically based art, as he travels widely to exhibit sci-art, to address conferences, and to participate in other forums. He perceives three different funding systems operating in the United States of America (USA), the United Kingdom (UK), and Australia.

In the USA, Catts suggests that the funding is driven by commercial companies who use artists to convey the impression that the new technologies are innovative, “just fun”, in an attempt to generate investment and to assist in their public acceptance. It is not the companies’ aim to create cultural discussion or
debate. In the UK, Catts claims that most of the funding is provided by the Wellcome Trust with whom he and Zurr have had negotiations as members of the TC&A Project. For Catts, the purview of the Wellcome Trust has spread into diverse areas as it was established as a non-profit, private organisation to support biomedical research, and currently funds projects with pharmaceutical companies and selected proposals by artists who work in the bio-art field. The Trust’s investment in pharmaceutical companies presents a problem, according to Catts, as it could be construed as a conflict of interest when proposals are submitted for projects which question aspects of biotechnology and raise ethical issues.

In the UK, Catts notes that, despite the prevailing opinion that ethical issues surrounding biotechnological developments are being addressed, there appears to be limited discussion about biotechnology’s role in the future. In conversations there, he was informed that there were sufficient debates already taking place concerning biotechnology, and that it was unnecessary for artists to become involved. His concern is that, due to the dominance of the Wellcome Trust, opportunities are limited for organisations to create a more critical discussion, and that critical engagement with and discussion about biotechnological developments have been curbed in the UK, resulting in a superficial debate. Despite these perceptions, Catts believes that the discussion is more developed in Europe than in the USA. However, from their personal experiences with the Wellcome Trust, both Catts and Zurr reflect that the Trust’s preference is to fund artists who wish to engage with biotechnology but who do not wish to critique the serious implications of the technologies.

In the USA, Catts and Zurr note that in the sciences, and especially in the field of biomedical research where there is a vision that consumer products are going to derive from the research, the research is no longer basic or curiosity driven but is profit driven. This is a difficult issue, according to Catts and Zurr, because “sometimes the most problematic technologies are in the hands of the big corporations”. If artists wish to comment about these problematic technologies they need access to them to inform their views. However, to achieve this, the co-operation of the corporations is necessary, and, according to Catts and Zurr, artists need to operate in a “smart” way in order to both gain access and to retain their integrity. It is a fine balance, but the need to “walk the line” adds to the excitement of their work.
and has honed their skills in navigating around the various forces that impinge on their art practice.

Nevertheless, Zurr and Catts discovered that some scientists are also critical of the way the research funding system works, and that they alluded to an emphasis on research that is oriented towards an end product, rather than research that is valued by scientists as investigative and legitimate. Sulston warns that privatisation poses one of "the biggest threats to science" (Australian Associated Press, 2003, p. 54). From Melbourne to São Paulo and Beijing, and in his book *The common thread: A story of science, politics, ethics and the human genome*, Sulston has been campaigning against the abuse of the patenting system in relation to human genetic information. He claims that such practices restrict the character of research projects, limit communication between researchers, and make possible a climate in which the economic interests of large pharmaceutical companies could prevail (cited in O'Neill, 2003). Cormick (2002) reveals that a study in 2001 found that Australians viewed large multinational companies as "driving biotechnological innovations" and that society and governments were powerless in face of the "international financial and political power" that the companies wielded.

**Implications of funding**

**On creativity**

In response to the questions about funding and its possible influence on creativity, Zurr asks "How does one define creativity?" She agrees that a person can be creative by producing beautiful pictures, but a critical perspective is the main criterion for the TC&A. Zurr and Catts are aware that artists who receive money from sponsorships and corporations are frequently expected to "sex up" the company's public image, and they propose that art created under such funding is not as strong as art that critiques the field of biotechnology. Some participants envisage the possibility that a few artists and scientists could be tempted to compromise their professional integrity by chasing corporate funds.

Clancy surmises that there are two ways that funding could influence creativity. The first way is the long held belief "that some artists might feel pressured, feel a responsibility, or feel they don't have freedom — the old idea
that funding contaminates creativity." That aside, people work in different ways and, according to Clancy, although one person might feel restricted, another "might work really well within those limits and retain their creative integrity".

Benjamin has received corporate funding but has not applied for a government art grant, and sees both advantages and disadvantages for a traditional artist to be involved with institutional funding bodies. On one hand, despite the financial hardship, there is a freedom of practice if artists are independent of funding if that funding brings with it a restrictive agenda. Also, being forced to work outside the studio part-time to earn an income keeps artists in touch with the everyday world of the community in which they live. This interaction frequently informs the artist about the 'real' world, he says. However, the recent strong demand for Benjamin's work suggests that he may no longer need, or have the time, to seek work outside his studio. On the other hand, Benjamin acknowledges the necessity for, and the benefits of, government support for artistic endeavour.

Similar to the vaunted programme of "embedding" journalists with the troops in Iraq, Cleworth is concerned about the danger of creating a bond or situation between the artist and the funding body whereby the artist is tempted to be less critical than would otherwise be the case. Cleworth suggests this trend is already evident in some recent biotechnologically based exhibitions he has visited where he did not 'feel a great sense of critical engagement with their processes and the subject matter that they are dealing with'. However, he concedes that it is early in the development of this field and he is hopeful that more interesting work will be produced in time.

According to Cleworth, the competition for grants could encourage artists to develop projects that they anticipate are going to be assessed favourably by funding bodies, but he also notes that visual artists have always been interested in stylistic or technical developments. His perception is that projects that are seen as cutting edge, or that engage with new technology, frequently receive more substantial funding, and he asks whether they are assessed on an understanding of the nature and merit of the project in contrast to their superficial attraction. Cleworth questions whether this push for art to engage with new technology is coming from particular institutions wishing to enhance their profile.
Cleworth believes that funding does not exclude good art work or good art practice, nor does it exclude good research. "Good artists will always produce good art work whatever the environment!", he says, but he anticipates changes will be triggered in the mode of art practice if funding is linked with direct commercial outcomes. He alludes to parallels developing with nineteenth century academies in Europe and Britain, especially France. If the available money is pooled and careers are made through the artists' connection with government or large institutions, similar to the nineteenth century, Cleworth reminds us that powerful forces come into play and artists could be obliged "to conform in major ways". His assessment is that history shows that not a lot of interesting work came out of the academies, and, although some amazing technical developments, and technically accomplished work, came out of that period, the creative work that engaged with the cultural and social conditions of the day surfaced from outside the institutional system. He cites Courbet as an example. At the beginning of the twenty-first century, the Venice Biennale, the Sydney Biennale, and other large scale showcase events, where artists wish to exhibit to seal their position as cutting edge, are examples of venues over which "the State has a huge level of power". Despite all the hyperbole surrounding these events, Cleworth regards the majority of the work as conformist. That aside, Bunt points out that it is becoming more and more difficult for the "single artist or the single scientist to practise in their back garden" because they "need $50,000 worth of equipment". Although new media and research funding grants may now claims for equipment, most grants available to conventional artists preclude such items.

Castleden hopes that the competition for funding will not influence the creativity of the artist involved and will not limit the scope of the subject matter of the work. In spite of these concerns, Castleden celebrates the expansion of funding if that funding "supports work that crosses disciplines or pushes the boundaries of what science is, or what art is".

Provided the goals of the funding or sponsorship body are in line with those of the artist and scientist, creativity should not be stifled, according to Edmondston. She suggests that "perhaps it is a matter of using your creativity to produce a sci-art project that meets the requirements of the funding body, and also achieves your own goals. Maybe that's where the creativity lies."
Edmondston asks whether funding for art and science projects “is an agenda to increase the acceptance of specific technologies based on art/science as a science communication message”. She suggests that a sci-art collaboration incorporating cutting edge technology and innovative science could be assessed more favourably than a pure research art and science collaboration, because of its novelty, high profile, and “sexy” science image. Edmondston speculates that a sci-art proposal that puts a “positive spin” on a scientific or technological innovation which does not enjoy universal favourable public opinion, such as genetically modified food, could receive funding over another proposal that is not as topical.

Although, according to Edmondston, science projects with technological and innovative outcomes receive strong funding, she suggests that “quality projects” in pure research will still be funded despite the competition for grants. Nevertheless, she conjectures that some good research projects that incorporate a creativity component could be overlooked for funding because they do not “fit into the technology and innovation requirements”.

Outcomes are of prime importance today for funding bodies and they are influenced by fashion and fads, “by what is in vogue”, declares Kuhaupt. Corporations ask “How are we going to make money out of it?” In this respect, he conjectures that the people who receive funding are not necessarily the best applicants, nor do they necessarily have the best project or art idea.

With regard to creativity, Mcikle judges that the competition for funding is “probably more of a negative than a positive”. He proposes that one positive to emerge is that competition will mean that the higher quality projects will be funded, and, as a negative, the possible “effect of directing research in certain targeted areas that may or may not be the directions in which research and art should be going”. In addition: “Funding from the corporate sector is usually designed for a commercial purpose and this inevitably means that there are some constraints on what you can do, and on the creative process.” His summation is that “funding does have a subtle possibility to negatively affect the creative instincts of both artists and scientists.”
Meikle suggests that the result of government bodies encouraging collaborations, and a cross-disciplinary type of art and research work, could present a “two-edged sword”.

On the one hand it means that there is the funding to be creative and to have a certain amount of freedom to pursue these projects both in art and in science. On the other hand, it also means that funding bodies have the ability to subtly direct what those activities are because they can target the research or the art. (Meikle)

McLachlan perceives a similarity between funding and sponsorship at the beginning of the twenty-first century and the medieval system of patrons, also noted by Cleworth and Nicholls. He suggests that the constraints on creativity today could arise, not from the competition, but from the sponsors “determining an agenda” and calling for “competition around a theme”. Those themes may not necessarily “match those that the scientist or artist would be interested in pursuing spontaneously”, and the result is that the contenders could tailor their application to suit the sponsor’s theme, proffers McLachlan. Buckley and Conomos (2004) have similar concerns (see Chapter 8). This, McLachlan contends, raises several issues concerning funding and targeted outcomes: the relevance, or otherwise, of the outcome to the original theme; and the unpredictability of the outcome of research, particularly in the biological sciences.

Nicholls has no experience of the current art funding regime but conjectures that it is no different from the situation during the Renaissance when patrons set the agenda. However, she notes that there are social issues around scientific developments; for instance, the social interpretation and acceptance of new ideas, and funding could influence the way these matters are addressed.

Bunt acknowledges that the question of whether artists or scientists who apply for funding or sponsorship target their work to conform to institutional conditions, or proceed without feeling directed or limited by the funding, is complex. Although he thinks artists are not necessarily making targeted art, he suggests that the funding may limit what they do. However, he believes that most artists would refuse to do a particular piece of work rather than change it to receive funding, or to be accepted by a gallery. Therefore, gallery management also plays a role in the censorship of art through the funding and staging of exhibitions (see Chapter 4).
There are subtle differences in the opinions of the participants, but an overview of the comments put forward in this section provides the following: the artist or scientist could feel their capacity for criticism is limited by their relationship with and/or dependency upon the funding body; many funding bodies are influenced by current trends, or superficial attraction, and could target the project towards a commercially viable outcome, or limit the scope of the subject matter; some funding bodies could require the project to promote the acceptance of specific technologies, or to put a "positive spin" on new developments not universally accepted; some funding bodies could assess submissions embracing novelty and cutting-edge technologies more favourably than others to improve their image and raise their profile; artists and scientists could structure their projects to comply with the funding criteria rather than submitting creative and explorative proposals; and artists and scientists could be obliged to conform in major ways.

On the positive side of the ledger, comments include: instead of feeling limited by the funding, some recipients could work well within the requirements and retain their creative integrity; professionals will work well in most environments; some participants doubt whether artists or scientists would accept funding if it directs them towards a particular outcome that stifles creativity; participants acknowledge the benefits of government funding for art and science, particularly as projects can proceed that were not possible otherwise; funding that crosses disciplines and supports work that pushes the boundaries of what science is, or what art is, is welcomed; and competition for funding could mean that higher quality projects are supported.

On conflicts of interest

Although the comments expressed here are similar to those in the previous section, they are directed towards issues involving conflict of interests, in practical and administrative terms, between the recipients, and between the funding bodies and the recipients. Artists who undertake corporate-funded projects and/or research have various options open to them: for example, some artists encourage commercialisation of their research; some are involved in corporate laboratories that ultimately exploit their research with little or no return, or recognition, to the artist; and others retain individual control over the results of their work.
Biotron is typical of the tangled web that grows when science and corporate funding interweave, posits Moynihan (2002). Extensive claims were made for the advanced biotechnological research intellectual property developed at the Australian National University (ANU), and a company was formed and floated on the stock exchange. As Moynihan portrays it, “scientists were mixing it with venture capitalists” (p. 49). A controversy erupted and inquiries were instigated by ANU and company regulators. Relevant matters to this study are raised by three ANU researchers, Laver, Mullbacher and Waring, who are not associated with Biotron. They consider corporate sponsorship could “lead to diminution in the free flow of ideas, a focus on more applied projects and serious conflicts of interest” (Moynihan, 2002, p. 51). Their sentiments accord with those of some research participants. Inter alia, the Biotron controversy prompted ANU to review its liaisons with private corporations.

Controversy erupted, too, over stem-cell scientist Alan Trounson’s 400,000 shares in ES Cell International Pty. Ltd., incorporated in Singapore, a company that originated from research carried out at the Monash Institute for Reproduction and Development where Trounson was Director. However, there was nothing illegal in his holding the shares. Researchers are frequently offered a share of proceeds or after-costs income from the commercialisation of any intellectual property derived from their research (Hope, 2002, p. 24). Based on these previous examples, it is important for artists to be aware of the legal issues involving copyright, intellectual property, and the various forms of remuneration applicable when signing contracts.

Clancy applauds funding for artists because it opens up exciting opportunities for artists to “realise their ideas”. On another level, she is aware that “there could be a negative side”. Expectations from the funding institutions form part of her concern. Clancy notes that there was criticism of the Paradise Now: Picturing the Genetic Revolution exhibition, New York, 2000/2001, sponsored by a large bio-tech company. The bio-tech sponsorship was seen as problematic because, according to Clancy, it was suggested that “there could be certain research outcome expectations and these could limit artists’ control”. She suggests that artists need to ascertain any potential circumstances that could limit their art work, such as the funding body having a preconceived idea of what would be produced from their investment, and to ensure that they feel able to work within that framework. That
aside, funding organisations frequently require acquittal statements following research projects, as do many art related sponsors including the Australia Council, and Arts Victoria. These acquittal statements could provide mechanisms with which to scrutinise, not only financial transactions, but other outcomes.

Clancy hypothesises that events relating to the work of Heather Ackroyd and Dan Harvey, who conducted collaborative research into grass to create art, represent a scenario in which complications could arise from institutional or corporate funding of art works. The headline on the website declares: “Hyperspectral Imaging leads to New Art Form, Greener Lawns. England’s fields may soon stay green even when the grass is dead thanks to hyperspectral imaging genetics – and avant-garde art.” In the article, the scientists acknowledge that working with the artists prompted the scientists to “think about hyperspectral imaging for studying grass”. The research led to a new grass which

the institute plans to market ... for use on the nation’s parks, lawns and golf courses within two years. The artists’ and scientists’ work will continue with the aid of a government grant. Their multidisciplinary collaboration resulted in a 30,000 euros L’Oreal Art & Science of Color Prize earlier this year [2000]. (Drollette, 2000)

If artists conduct research that leads to products with commercial potential, Clancy asks: “what if the artists sell their art works? What if they sell the images, the pictures on grass, which they have developed with the scientists from the institute?” Hypothetically, issues of copyright, and the conditions of the agreement under which the collaboration was established, would be pertinent should such events occur (see Chapter 6).

Another aspect that concerns Clancy is that, in some instances, artists could, due to their lack of scientific knowledge, unsuspectingly contribute to a development that later proves to be problematic. Catts and Zurr also signal that some of the new technologies are “highly risky and dangerous” and that artists dealing with them need to exercise due care and responsibility. The artist Joe Davis had such an experience. He states:

I still come up with ideas that are dangerous and don’t realise that they are dangerous. For example, there is a 200-mer [a sequence of 200 amino acids] that folds into a highly geometric capsule. I had this
idea of creating Kepler's nested polyhedra [once thought to define the planetary orbits] in these viral capsids. (cited in Gibbs, 2001)

Fortunately, Davis ran the idea by one of his genetics mentors first who "pointed out that I could inadvertently create a supervirus" (cited in Gibbs, 2001).

One facet of Davis' near misadventure appears to have been overlooked as I have not located any mention of it, as yet, in any commentaries. The British Medical Association's report, "Biotechnology, Weapons and Humanity II" (2004) warns of the lack of global agreement on an infrastructure to manage biotechnological advances that could be used for warfare. It urges countries to agree upon and strengthen the Biological and Toxin Weapons Convention in 2006. In particular, the report calls upon scientists to take responsibility for the possible impacts of their research, and to discuss with funding bodies whether the proposed research should be prohibited. In light of the Association's call, and Davis' experience, artists need to be cognisant of the possible impacts of their interventions in laboratories, and to ensure the ethical, legal and moral attitudes of the scientists with whom they engage are in harmony with their own. Davis' supervirus could have been appropriated by the scientists or others and used for nefarious purposes, if they were so inclined, without Davis realising the potential use of his discovery.

Cleworth proposes that the economic rationalist view, which he sees as permeating politics and our culture, is a factor in the encouragement and funding of linkages between art and science. He suggests that such linkages could be calculated to promote the concept that the new biotechnological developments have a potential for social and economic benefit. In addition, linking art with science could, according to economic rationalists, invest art with some greater or more direct purpose as a way to sell art to governments and the general public. Cleworth sees parallels with science funding that encourages short term, direct economic outcomes although some of the best work in both art and science takes years to evolve. The push to link research with commercial companies and networks is an element materialising in art institutions where pressure is being brought to bear to justify their programmes, according to Cleworth.

The science communication aspect of institutional funding interests Edmondston. She sees many difficulties in the relationship between scientists and journalists in the traditional methods of print and press where "a particular science
understanding often gets lost in the news or the print media”. According to Edmondston, there has been a push to expand science communication platforms beyond the more traditional methods in an “attempt to increase scientific literacy for social, political and economic reasons so that there is a better awareness.... Art and science collaborations can be used as a platform for research and communication programmes”. Her ideas coincide with those of Williams who, according to Eldridge and Eldridge (1994), believes that “Communication ... is intrinsic to culture as a way of life and not just a means for commenting upon it” (p. 77).

If the scientists and artists have common goals, Edmondston does not foresee a problem in sci-art collaborations. However, she counters that

if they [the artists and scientists] are constrained by the way the funding is set up, or the reasons for doing the project, or feel that either the scientists or the artists are pushed or channelled into one particular aspect of it, then that is going to be an issue in terms of providing constraints and will have definite impacts and implications for both the scientists and the artists involved. (Edmondston)

Although some scientists would collaborate for altruistic reasons, Edmondston doubts whether others would be involved if they did not identify an incentive appropriate to them, or agree with the proposed art outcome. On the other hand, she envisages that scientists, who are not necessarily in agreement with the art work, could agree to collaborate because funding is available. In that case, the funding could instigate something positive that might otherwise not have happened.

Edmondston identifies a dilemma between the recognition that there is a need to commercialise science outcomes, accompanied by a drive for technology and innovation, and the fact that there is proportionately less money being allocated to pure research. McLachlan recognises a number of agendas that have driven institutional and governmental interest in funding sci-art projects. “Possibly the most simplistic agenda has to do with the public understanding of science.” He suggests this “trivial way of using sci-art collaborations” is one frequently adopted by the Wellcome Trust, as noted previously by Wolpert (2002), see the section on The Wellcome Trust above. McLachlan is also concerned that the governmental agenda is driven by a view that art and science “are polar opposites”
and proposes that "a natural tendency in humans is to try to reconcile the irreversible, the Hegelian synthesis". In addition, there is a "fashion" for sci-art "that comes and goes". Therefore, McLachlan is concerned that the government agenda has "important consequences" for the scientists and artists working within that framework. It will result in "difficulties and confusion" if it fails to recognise "the real value" of art and science working together.

Possible areas of conflict of interests between the collaborators, or between the collaborators and the funding body, identified by the participants include legal issues such as copyright, intellectual property, and remuneration or royalties; issues of control of the project administratively; issues of decisions regarding the final outcome or product; issues of unanticipated developments, incidents or products; issues of responsibility for possible impacts of the research activities and/or outcomes; issues of the recognition of the 'real value' of the collaborative processes and their outcomes; and the social and cultural issues surrounding the work of some collaborators.

Summary

In Australia, the New Media Arts Board has been charged with encouraging cross-disciplinary collaborative work, and hybrid art forms, but support for the Board's funding activities is not universal. The Australia Council's decision, in December, 2004, to dissolve the Board and to create an Inter-Arts Office with responsibility for hybrid art forms is another indication of the blurring of boundaries between art practices, and between art and other disciplines, and of the emergence of new forms of art.

Some commentators suggest that the proliferation of new media work is primarily a result of government funding through grants and through the exhibition and purchase of the outcomes by government instrumentalities. Another reason proffered is the number of energetic, well organised institutions and lobby groups that have established a global network of conferences, symposia, and exhibitions to encourage experimentation and imagination in the development and proliferation of new technologies. In addition to the Wellcome Trust and other sponsorship organisations, these structures include bodies that have been founded in affiliation with universities in the UK and the USA to promote new media, such as the
Planetary Collegium. The intervention of these funding and promotional bodies in the relationships between art, science and the new technologies heralded structural change from which digital new media art activities emerged. Following the integration of these activities into the virtual mainstream, a new form, biotechnologically based art, emerged.

Although the Australian Government encourages corporate and private sponsorship through its various agencies, the level of corporate and private funding for the visual arts, including sci-art, in Australia is considered by participants to be low in comparison with other developed countries. However, several Australian artists have been funded by the Wellcome Trust and other international organisations as artists-in-residence, to attend conferences, and to exhibit their work internationally. In some quarters, the projects sponsored by the Wellcome Trust are assessed as ‘soft’ art and science that could be seen to trivialise sci-art. However, some participants consider that it is difficult to obtain funding for sci-art that critiques the new technologies, or that is ground-breaking.

According to some participants, funding that is accompanied by explicit or implied objectives could preclude investigatory or critical engagement, limit the freedom and creativity of the scientists and artists, and compromise their professional integrity. They suggest that corporations and institutions could see their linkage with art as a means to promote the social and economic benefits they claim for their products, and to increase the acceptance of specific technologies that are viewed with a degree of scepticism by some members of the community. One participant noted that, during the nineteenth century, when the academies and institutions were paramount, the most interesting and creative art came from outside that system. However, some participants relate that it is financially difficult for an artist or scientist involved with new media to work independently of a laboratory or sponsor, due to the expensive new technologies and equipment involved. In this instance, financial circumstances mediate against the pursuits of ‘creative geniuses’ who conduct their research independently.

Controversy can also arise when the corporate sponsor is regarded by segments of the community as socially or environmentally irresponsible as occurred in Tasmania in the lead up to the Ten Days on the Island Festival, in 2003. Conversely, certain corporations are now declaring their awareness of a need for
social responsibility and for a meaningful cultural contribution to the communities in which they operate. Their continued and expanded cultural contribution in the fields of science and the humanities will be welcome.

When funding is tight, competition is strong. One positive identified in this situation is the possibility that it is the better quality projects that will be funded, and a negative is the possibility that the work will be targeted to comply with the requirement for a short term outcome despite an awareness, in many quarters, that the best work frequently takes years to evolve. A similar situation pertains currently in art institutions where economic rationalism is forcing institutions to justify their art programmes in the short term rather than taking a long-term view which is more appropriate for traditional art practices. Although participants, both scientists and artists, recognise the necessity for the thorough assessment of funding submissions, they are frequently frustrated by the amount of information requested for some proposals and, consequently, the large amount of time devoted to preparing submissions, a situation that pertains in most areas of commercial life.

Participants comment on the possibility of conflicts of interest when the outcomes of sci-art projects have commercial potential. Again, they suggest that formal agreements be put in place before the commencement of the collaborative work. However, if the collaborators have established common goals, difficulties should not arise in that area. Several participants are cognisant of the risks inherent in sci-art research and point out that artists dealing with some new technologies and materials need to exercise due care and responsibility. One aspect not raised by the participants is the possibility that a dangerous product, created unwittingly by an artist, could be appropriated for nefarious purposes without the artist being aware of the potential use of that product.

Another aspect of the Australian Government’s agenda is the idea that art can be used as a vehicle to communicate and demystify biotechnological developments to the public. One participant agrees that art is a suitable communication tool for science and explains that the scientific understanding of research is sometimes lost in a journalist’s interpretation. However, most participants consider an artist’s role as that of critic, not communicator or illustrator, and would encourage the government to understand the cultural values inherent in creative endeavours. In contrast, Edmondston points out that institutional funding for sci-art collaborations that
expand science communication could assist to increase scientific literacy where more traditional methods have proved unsuccessful. However, McLachlan is concerned that the public understanding of science is one of the more trivial ways of using sci-art collaborations, and proposes that it is important to recognise the "real value" of art and science working together.

One threat to the opportunities for science and art to work together could result from the privatisation or patenting of research outcomes relating to human genetic information. Such practices could restrict interaction between researchers and artists and limit the character of sci-art collaborations. If an emphasis is placed on funding for research that is oriented towards a commercial end product rather than investigation, some suggest that society and governments could be powerless in relation to the intentions of multinational companies.

Many of the circumstances highlighted by the participants in this chapter indicate that artists need to be aware of their role in any proposed project or collaboration, and to ensure that they comprehend the implications of their involvement.
Endnotes

1 William Creek is located in outback South Australia on the Oodnadatta Track. It is South Australia’s smallest town and the gateway to Lake Eyre.


3 These high-profile defectors include Peter Carey, Tim Winton, Olivia Newton-John, and Jack Thompson, according to Schofield.

4 Berta Sichel is an art writer and academic who co-curated techno.seduction, 1997, an exhibition of multimedia installations by forty artists.

5 Sir John Sulston's comments are reported from his address to the XIX Genetics Congress, 2003, in Melbourne. Sir John shared the 2002 Nobel Prize in Physiology or Medicine, headed the British team on the Human Genome Project, and retired as Director of the Sanger Centre in 2002.


7 Paradise Now: Picturing the Genetic Revolution was sponsored by The Bohon Foundation, Jerome Foundation, the Joy of Giving Something Inc., The New York State Council on the Arts, Roy and Niuta Titus Foundation and members of Exit Art.

CHAPTER 8

ATTITUDES TOWARDS THE ISSUE OF CREATIVITY: PROBLEM SEEKING AND PROBLEM SOLVING SKILLS

They say that time changes things, but you actually have to change them yourself. (Andy Warhol)

Introduction

University administrators are currently placing more and more emphasis on quantifiable outcomes in areas such as cost per course in relation to EFTSUs, graduate employment, corporate funding of research, and the consolidation of curriculum units into generic modules to rationalise the number of academics required on the teaching staff. These initiatives are in response to variations in the Australian Government funding to universities, but have implications for the knowledge outcome. My experience, and that of some of the participants as mentioned in other contexts within this thesis, is that visual arts departments have been among the first to come under the economic rationalist microscope despite the contention that the humanities foster the innovative, lateral thinking that supports a knowledge economy.

Issues of education and the visual arts, and notions of creativity and innovation through art education, are discussed in Chapter 4. In view of the recent push by the Australian Government for innovation, in this chapter I ask the participants for their attitudes towards the notion of creativity, and the value or otherwise of problem seeking and problem solving skills.

The use of the word 'creativity' linked with 'scientist' proved problematic for some interviewees who were adamant that scientists are not creative. Some took the opposite stance and others ranged between the two poles. The participants'
enthusiasm to address questions around the topics of creativity, and problem seeking and solving skills, demonstrates a lively interest in the subjects. Many perspectives emerge and some of the issues raised have implications for the manner in which creativity and innovation are addressed, not only in science and art, but in wider applications. The extent of the link between creativity and the notion of the 'discards' is discussed in Chapter II.

Thoughts on creativity from recent literature

Creativity is not confined to an artistic life but extends to individuals who seek to move out of the routine of ordered daily life and to determine the form and content of their life, [to] experience the rebellion of life within their own selves, and they find themselves in profound alienation from much of the traditional culture. So they are in the midst of the crisis that is characteristic of creativity generally: the crisis of estrangement, alienation, otherness, difference. (Hofstadter, 1985, p. 203)

Ragsdell (1996) extrapolates Hofstadter's outlook to the corporate world. As organisational management becomes increasingly complex the ability to think creatively will be critical, she asserts. Ragsdell acknowledges that "creativity is a quality that defines the arts. This is rarely the case in the sciences, in particular the sciences of management" (1996, p. 141). Similarly, my research indicates that creativity and complexity are issues pertinent to the successful establishment and management of scientist and artist collaborations where stereotypical attitudes are being challenged.

In 1970, Maslow proposed that more study be applied to the sociology of science, and defined some differences between the 'idealized' artist and the 'idealized' scientist. He claims the artist "is usually a specialist in knowledge or discovery of the idiographic (the unique, the idiosyncratic, the individual)" and that the scientist "is a specialist in the nomothetic (the generalized, the abstract)". He also claims that, although the artist is close to the scientist as "problem discoverer, questioner, or hypothesizer", the exclusive responsibility of the scientist is as "problem solver, checker, and certainty maker" (Maslow, 1970, p. 8). Shearer and Gould (undated) disapprove of the use of stereotypes such as those specified by Maslow. The participants' comments also indicate that aspects of Maslow's findings
are not accepted universally, and my research supports more recent perceptions that the world in which we now live is of a more interdisciplinary nature.

Florida (2003) argues that technology, talent and tolerance are the three keys to developing a creative environment. His research indicates that local governments who cultivate environments that appeal to the creative classes are more successful in developing cultural capital and vibrant economies than those who concentrate on subsidising large shopping malls, call centres and similar ventures. In addition, he emphasises that creativity is multidimensional and includes aspects of technological creativity, economic creativity, and cultural and artistic creativity. Eakin (2002) reports that the *Austin American-Statesman* requested Robert Cushing to test several social and cultural theories that could be related to Austin's rapid population growth. Cushing admits to being "very sceptical of the creative-class notion". However, he was surprised to discover that his preliminary research suggests that Florida's theory provides "the best explanation for Austin's high-tech transformation" (cited in Eakin, 2002).

As a result of the more interdisciplinary and multidimensional attitudes currently being encouraged, authors now appear more willing to refer to issues that were formerly greeted with scepticism, derision even, such as intuition and serendipity in science. For example, McLachlan reveals later in this chapter how his first sci-art collaboration undermined, for him, the prevailing myths about artists and scientists.

**Intuition and serendipity**

Collis (2004) deduces from the interviews he conducted with scientists, that 'serendipitous' discoveries predominantly arrive to the prepared mind: a mind that is prepared through research, study, and contemplation. As well as the prepared mind, Serjeantson (2004), from the Australian Academy of Science speaking on The Science Show: Serendipity in Science,^1^ 2004, nominated fantasy as an asset that aids 'serendipitous' breakthroughs. She also agreed with other panel members Julian Cribb and Brad Collis, and audience members, who claimed that many scientists associate a relaxed state of mind with the time at which they enjoyed a 'Eureka' moment. The majority of scientists Collis interviewed, and also those present in the audience, frequently compared this relaxed state of mind with being in a garden.
Pressed to respond to questions about the level of government funding for science, another panel member, the Federal Minister for Education, Science and Training, Dr Brendan Nelson, spoke about the Australia Council’s programme to support links between science, art and creativity.

The relaxed state of mind could be the state others recognise as ‘play’ and which they claim forms a function in creativity. Recent research in psychology addresses this subject but an in depth analysis is beyond the scope of this thesis. However, I mention a couple of pertinent instances. Freeland (2001) asserts that our “emotions, intellect, and imagination” are triggered by an aesthetically sensuous object, and that this reaction is connected with “free play” (p. 14). Artists have alluded to this stimulation over the years, and recently Katherine Hall* made a similar observation in discussing her art practice (K. Hall, personal communication, April 02, 2004). Others who have commented on the positive role of ‘play’ in creativity include Smith (1988, pp. 153-154), and, in the literature review, Wilson (1996), Herd (2002), and Ragsdell (1996). Indeed, Bunt acknowledges that some scientific advances are serendipitous and arise when an observant scientist detects the possibilities in an unexpected occurrence (see below). These open acknowledgements of the role of ‘play’, or ‘lateral investigation’ call into question the stereotypical image of the scientist and artist. They are also examples of a wider understanding and acceptance of multiple forms of functioning as proposed by Greene (2000).

During his collaboration with Storey, McLachlan discovered that artists do not live according to the myths surrounding them, and, in the process, realised that scientists, too, are not stereotypical. Misleading myths about scientists and artists cloud the issues, according to Kemp (2000), who observes that both scientists and artists participate in the construction of “human mental and physical landscapes”. He claims they share “structural intuitions” and applauds the way in which “these intuitions have manifested themselves in the works of innovative artists and scientists in culturally opposite ways” (Kemp, 2000, p. 7). According to Vesna (2001), both scientists and artists intuit changes in perception and materialise those changes for society to experience and debate (2001, p. 122). Following from this, I note that scientists whom Hoffmann and Dukas (1972, passim) nominate as intuitive include Einstein, Huygens, Young, Faraday, and Maxwell (1972, passim). As Silverman
(2000) reminds researchers, it is useful to look beyond mere categorisation and to seek the links between subject elements (p. 825).

**Political and corporate attitudes to creativity**

During the 1990s, a new awareness of the part creativity could perform in projecting Australia towards the goal of a 'creative nation' informed the Australian Government's initiatives of conferences and workshops to foster innovation. In 1992, the Australian Government appointed a panel to advise it on the formulation of a Commonwealth cultural policy. The Creative Nation: Commonwealth Cultural Policy was announced in October, 1994.

At one of the subsequent workshops hosted by the New Media Arts Board in Canberra, in 1999, Bunt reports that a politician [unnamed] stated that "a well developed and cultural Australia, to call itself a civilised nation, needed art and science as a luxury to enrich its society". Bunt found it interesting that it was the representatives of commerce in attendance who took the more positive view of science and art and recommended that both were necessary for the good of the country as they encouraged creativity. The politician's perception, that art and science are needed on the basis that they are luxuries that enrich a society, is an example of the attitudes the participants who advocate cross-disciplinary education wish to overcome. The perception concerning art could stem from reports connecting Renaissance patronage of the arts with the wealthy and the church, the promotion of the purchase of art as an investment, and the view, in some quarters, that art serves no useful purpose. The participants suggest that the exhibition of 'difficult' art work with inaccessible didactic panels also encourages the attitude that art is elitist. In relation to science, I contend that it is a problematic exercise to endeavour to construct a framework to support a claim that science is a 'luxury'.

In another move to encourage diversity, creativity, innovation, and commercialisation of new ideas, the Australian Government and corporations combined to establish the 2004 Australian INNOVATION Festival, with the theme "Learning, Living, Creating". However, Buckley and Conomos (2004) contend that the Australian Research Council's (ARC) funding policy for art encourages artists "to develop research projects that do not represent their primary intellectual concerns as artists but do fit neatly into the ARC funding categories" (p. 40). Their concerns
reflect those of McLachlan, although his relate to an international view and not to an Australian perspective in particular. Buckley and Conomos also claim that the Harvard Business Review (HBR), February 2004, reports that Australia was rated outside the top 15 countries on a creativity index designed as an indicator "of a country's ability to achieve growth" (2004, p. 40). However, Florida's (2004) HBR article cited figures from a survey, *Europe in the Creative Age*, Table 4: The Euro-Creativity Index, with the USA listed as a comparison to Europe. His reference to Australia states:

Other [italics added] research indicates that Canada, Australia, and New Zealand have built dynamic creative climates. Toronto and Vancouver, Canada, and Sydney and Melbourne in Australia compete very well with major U.S. regions like Chicago and Washington, DC. (Florida, 2004, p. 15)

Buckley's and Conomos' article prompted a riposte from Thomas' (2004) who calculates that the recipients of ARC grants from arts and architecture "have increased from 8 per cent in 1996 to 17 per cent in 2003 within the humanities and creative arts fields" (M. Thomas, 2004, p. 39). A case in point is the ARC Discovery Grant awarded to Professors J Chan and N Brown, of the University of New South Wales, for research titled "The making of creative artists". The project is designed to examine how creativity is developed among artists. The acceptance of proposals of this nature might encourage university administrators to join commerce and the Australia Council to support the continuation, if not the expansion, of the presence of visual art departments in universities.

Problem seeking and problem solving skills and the creative process

In this thesis I have linked creativity with problem seeking and problem solving skills because, while I agree with Zolberg (1990) that their particular characteristics can differ, I consider them complementary. She suggests that scientists and artists share some characteristics in problem solving but differ in that science "emphasizes intellectual communication" and art requires the "communication of subjective knowledge", and adds that problem finding skill is vital in the modern world where innovation is prized (1990, pp. 121-122). Minsky
(1990) ascribes both problem seeking and problem solving skills to artists (pp. 230-231). Here again, education is regarded as integral to this process.

Reform to educate for creativity was a notion introduced in Australia in 1943 by Sir Herbert Read, according to Smith (1988), who explains that the idea was to “train a different power of mind than rationality – creativity in general”. This was a false assumption, Smith asserts, because, in his opinion, creativity does not lie in the subject being taught, for example art, “but in the manner in which a subject, any subject, is taught”.

Read’s false theory has led teachers of art and craft to make false claims for their subject that cannot be sustained. And it has led to a damaging distinction between professionalism in art, which is concerned with skills in the production of a special kind of object, and the proposal by art teachers that their business is to draw out creativity in general. (B. Smith, 1988, pp. 54-55)

The manner in which visual art students are streamed will channel their approach to problem seeking and problem solving, predicts Caves (2000, p. 22). Those students streamed towards a commercial art practice will adopt the attitude that their employer(s) will provide the problem and the student will provide the solution. On the other hand, the students anticipating a fine art practice will be “successful at spotting novel problems and solving them in fruitful and compelling ways”. Caves (2000) indicates that students who embrace the problem seeking and solving path find their rewards “not from the work but in the work, rewards derived not from the product but obtained in the process of production”. He locates a correlation between a problem-solving art practice and scientific research but qualifies this by claiming that the artist will formulate the “problem and solution internally, in a way that is perhaps not really self-articulated”, and the process will lack “scientific precision” (p. 22).

Long concurs: “It is the creative process that creates both art, and, to some degree, science” he says, despite the advent of new technologies. The differences he discerns between creative processes in art and science are that scientists are less creative in that “scientists start off with a specialised area, with data ... and rely on new discoveries or designing new experiments et cetera” and the creativity derives from the lateral thinking or interpretation, whereas art comes from the “more classical side of the mind” and is required “to create
something new in order to present something that has not been seen before.” The patterns from the research data indicate that we are at the threshold of a transcendence of distinct dichotomies between artists and scientists, see Kemmis and McTaggart (2000).

Elaborating, Long suggests that imagination is useful to scientists as it can assist them to illustrate and to convey the data from their scientific papers to the public and thereby encourage community enthusiasm and support for their work. As discussed in Chapter 6, imaginative artists have assisted Long in the illustration of difficult palaeontologic concepts “that have not been seen before” both for the Western Australian Museum and in the books he has written. Hill, a geologist, also suggests that, due to perceived difficulties with communication, perhaps scientists should be creative in the way they present their explanations.

Castleeden considers problem seeking and problem solving skills essential for an artist and enjoys challenges in both her art practice and in her teaching. She perceives that a student who is searching for a way to negotiate a problem is a student who is doing quite well. Although she had not thought about it previously, Castleeden senses that there could be a parallel between scientists and artists in this area.

Catts and Zurr agree that

basically artists are problem seekers, they generate problems to solve. The problem artists are trying to solve is how to tell the story, and the problem for the scientists is how to gain the knowledge in pure scientific terms. So, here, it is supposedly the subjective and the objective colliding, although lots of good scientists have found that their solution is by being able to tell their story better. (Catts and Zurr)

The dilemma that scientists face, to be “able to tell their story better”, is a recurrent theme throughout this research. A circumstance which Catts and Zurr have experienced at SymbioticA supports the idea that artists are problem seekers and problem solvers. At SymbioticA, participants are welcome from many different disciplines but it appears that it is the artists who are the most likely people to become involved in collaboration with a scientist in the wet laboratory. Catts and Zurr have discovered that artists seem more willing to “go native” in the laboratory, and to be more comfortable making mistakes. “Artists can celebrate failure”
opines Catts. (However, most funding criteria do not entertain the notion of failure as a valid part of the process of discovery). As an example of different cross-disciplinary approaches, Catts cites the incident of an anthropologist [unnamed] who was very interested in the scientific promise of tissue engineering as a way to replace the illegal trade in organ transplants. However, after three hours, the anthropologist left SymbioticA and did not return. Clearly, the wet laboratory environment does not appeal to everyone. An artist and research participant, Clancy, enjoyed her residency at SymbioticA as discussed in Chapter 3. The disparity does not indicate a statistical difference, but it may give an insight into disciplinary difference. The experiences of Joe Davis in laboratories in the USA are discussed in Chapter 6.

From her collaborative experiences, Clancy says that there are different ways of looking at problems, and there is a different research language in terms of the questions asked by artists and scientists. Her perception is that problem seeking and problem solving cannot be separated because to solve a problem you have to seek a problem. "You have to think of a question in order to ask it." In her opinion, problem seeking and problem solving skills are "really, really important for artists". Although many people who study at art school do not continue with their art practice after leaving, Clancy subscribes to the view "that learning to think creatively is really valuable for society", an issue reflected upon above. Another factor she raises is that "working with art is a lot about decision making". An example of this is the knowledge of when "to let go of the work, when it is resolved, and realising that the work has its own integrity", a vital question for generations of artists. Clancy emphasises that problem solving skills impinge on many areas of art practice and artists are aware of several factors: for example, that problem solving skills apply in art related philosophical, financial and physical matters; that art is not about compromise; that it is necessary for an artist to remain focused and dedicated to the concept; and that artists need to find their own solutions. As an example of an artist who chooses or finds aesthetic problems, Clancy cites Melbourne based artist, Kathy Temin, who examines spatial problems and whose works have titles such as Corner, Green and Brown Problem.

Cleworth, who has not been involved in a sci-art collaboration, declares he has limited knowledge of scientific methodology, but, from what he has read and heard, it appears to him that creative scientists have similar processes to creative
artists. He describes the creative process as one which involves “lateral thinking” and the opportunity “to go off on tangents for very long periods of time”. Of course, such a process is not acceptable when there is pressure applied for an economic outcome. Therefore, for Cleworth, the creative process in art mirrors that in science, except that art is a cultural product. Here I interject to observe that, in my view, this distinction is blurred with sci-art such as *Worry Dolls* and *Pigs Wings*. The works are products of a scientific laboratory setting. The works are exhibited by people who are reviewed as artists. The works are termed ‘sci-art’.

In Edmondston’s estimation, undergraduate science training helps develop both problem seeking and problem solving skills, but she advises that overall definitions are difficult due to the different levels and the different skills involved. With regard to the relevance of problem seeking and solving skills to an artist, Edmondston speculates that, in a sci-art collaboration, “if the scientist and the artist were open-minded and inquisitive then that could work quite well, whereas if the parties came in with a completely different philosophy that could be a problem.”

Problem seeking skills are an important activity, a highly regarded skill, for artists who work to improve in this area, according to Kuheupt. He reasons that artists use problem solving skills to create the art work, and to resolve the results of research and artistic exploration into “some sort of form ... the actual form you are after”.

This idea of the artist’s ability to resolve the results of research and exploration into an appropriate ‘form’, and the prospect of new ideas emerging through the stimulation of lateral thinking when artists and scientists collaborate, is highlighted by Laurie Anderson’s association with NASA. Her appointment is discussed in Chapter 6. On top of the beneficial possibilities mentioned here, Anderson’s appointment is possibly related to addressing public sensitivity to NASA’s ill-fated Challenger, 1986, and Columbia, 2003, projects, and the building of better communication between the organisation and the community. As stated previously, several participants claim communication is a key issue for many scientists.
Long declares that, although some scientists and scientific organisations may have problems with communication skills, all good scientists need good problem solving skills in order to qualify for a PhD. As Bunt would have it, problems with communication skills often evolve because scientists become caught up in their own specialist world, but communication skills are becoming increasingly important to scientists based in universities and government institutions who are regularly required to deal with the media, and to account for public expenditure. Therefore, art in the broad sense, not just visual art but writing, and literature, can play a part, he states. I suggest that the intense pressure to write successful grant applications constitutes another imperative for scientists to explain their research, or proposed research, to a wider audience.

In his area of physics, Meikle identifies “problem seeking and problem solving abilities as being at the heart of a good productive and creative scientist.” Acknowledging his lack of familiarity with art practices, Meikle assumes that these skills would be just as important for an artist, and he posits there is an “overlap between the skill set that an artist has or needs and the skill set that a scientist needs.” Problem seeking skills include the ability to identify the questions that are worth asking, and, as Meikle would have it, problem solving skills relate to architecture more than the visual arts.

I think architecture is a good example of where the practitioner needs the ability to solve problems all the time because they are continually trying to grapple with the clash between form and function. For example, how do we make something that is actually sound but also aesthetically pleasing? (Meikle)

Meikle assumes that all artists would face similar dilemmas and need problem seeking and problem solving skills as well as the skills to convey “what it is they are trying to say in whatever medium they choose to use.” The flexibility in choice of form correlates with McLachlan’s views on flexibility in choice of avenues of exploration.

McLachlan notes “many parallels between scientists and artists as kinds of people” including their need for the “flexibility to explore” new discoveries as they present themselves. He admits that this is an “unexpected” realisation for him as he had “probably bought slightly into the myth that artists
and scientists are different kinds of people", but, during his collaboration with "a very creative artist", he "was struck more by the similarities than by the differences". (Mclachlan's collaboration with Professor Helen Storey is described in Chapters 3, 5 and 6.) One similarity is that both scientists and artists do not appear to be motivated by money; money is not their primary motivation; they are "not greedy in that sense". Rather, Mclachlan identifies esteem and prestige as motivating factors for both categories, and he names their peers as their primary audience. Public acclaim is "not valuable in itself" but is an indicator to their colleagues "that they are doing well". He identifies another similarity in the desire of both scientists and artists "to bring about major change, to be the first do so something", as being the second person to "do something is pointless".

Nevertheless, innovation without inspiration, and the notion that "a great artist is almost always an innovator" can be misleading, claims Mclachlan. As an example, he cites art work he has seen that suggests to him that the artist has attempted "something different for the sake of doing something different, rather than because it has actually worked for them."

According to Piccinini, one similarity between artists and scientists is their interest in new ideas, to do something different, something better, something interesting, and to add something positive to the culture in which we live.

Problem seeking and problem solving skills are valued by the Ruskin School of Drawing and Fine Art, the fine art department at the University of Oxford, which admits 18 undergraduates each year. As part of the selection criteria, one whole day is devoted to the drawing examination and "an ability at visual problem-solving" is one of the three attributes examiners look for during this assessment. Although the Ruskin School appreciates these skills for artists, it does not necessarily follow that scientists would also require the same abilities. However, one programme that contemplated the possibility that artists could intuit phenomena that later were seen to have a connection with science was Sight, the Brain and Modern Art on Radio National.

New work on how the brain reacts to images suggests that painters are intuitive neurologists. A correlation can be drawn between trends in modern art and recent discoveries about the brain. For instance, just as artists began to dedicate specific works to the exploration of colour, form or motion, scientists revealed that these tasks were located in
different areas of the brain. Together, these two fields are changing
not only what we understand about perception, but also what we
understand about consciousness. (Cathcart, 2001, January 15)

If humanity is to meet the challenges of the ‘creative’ and ‘innovative’
community that governments envisage, the populace needs problem seeking and
problem solving skills. Bryce (2004) reminds his audience that, in the future,
“talented thinkers who know how to create ideas” will be in demand, and that
“capital will flow to the areas of our economy that provide the environment for
creative thinking” (p. 11).

Scientists are not ‘creating’

Similarities may exist in all human creativity, says Wolpert (2002), but that
there is any particular similarity between artists and scientists is not established. He
continues: “The similarity between art and science is even less than that between
billiards and rugby both of which at least use a ball”.

Bunt agrees. He suggests that the hypothesis that artists and scientists are
both ‘creating’ is false. He posits that, although they might physically be doing the
same thing on the bench, their motivation and thoughts are totally different. He views
this as positive because it can initiate new developments.

“Scientists don’t solve problems”, says Bunt, when asked about problem
seeking and problem solving skills. “Science identifies problems and finds
problems.” Although he acknowledges his explanation as a generalisation, Bunt
suggests “engineers solve problems, scientists find problems, and artists
make problems”. He elaborates: “scientists are not really looking to solve
problems, they are looking to find what is there and, if that leads to more
questions, all well and good.” He adds that the hypothesis a scientist proposes may
or may not be imaginative and creative, but the hypothesis is “worthless until it has
been shown to be true or not true, that it is false or not false”. This position
concurs with Karl Popper (1902-1994), who proposes that the scientific approach is
based on the disproving of hypotheses, or the failure to disprove them. Bunt
identifies “good challenging art” as art that invents or creates tensions, so that
“things which are not necessarily there are created”, as mentioned in Chapter
11. Here Bunt identifies art that creates tensions as being challenging, while Dunbar
claims that a factor common to most of the creative scientists in his research "is their ability to take risks" (Dunbar, 1997, p. 489). Serjeantson (2004) also identifies mavericks and risk-takers as being among those who have contributed to progress in science.

Bunt suggests that scientists may need to be creative in their approach to a technique or to technological problems. In this sense, scientists, artists and engineers may all have to be creative, to find problems, and to solve problems, at different times, but their core motives differ. As with other researchers, scientists aim to create new knowledge, not to make something new, which is a different exercise. Bunt claims that "Why' is the central word for any good scientist, whereas 'how' is the word for an engineer." Major beneficial learning experiences to emerge from the sci-art interdisciplinary interaction include the knowledge and greater understanding the parties gain from the different ways in which other disciplines work.

Question 5, to me, raises one of the very, very important things that come out of sci-art – that the parties involved have to learn that of each other – that there is a real, real difference. One of the biggest learning experiences of sci-art collaboration is, I think, what the difference is, what creativity is, and the way artists work. Artists work in such a different way because, for an artist, it doesn't really matter how you get to your truth or your problem solving if it creates what you want to create. For a scientist, the methodology is crucial, and, for an engineer, the situation is more like that of an artist. For an engineer it doesn't matter how you get there as long as it works. (Bunt)

Minsky (1990) sees it differently. He claims that, when he discusses with his friends the "common belief" that scientists think rationally and artists think intuitively, he "often find[s] quite the opposite".

Yes, scientists tend to be conscious and deliberate when they work on the details of their subjects, but they only rarely dwell upon the question of how they get their ideas – while our artists (if they are different at all) are less concerned with performances, but tend to reflect a good deal more about how to develop their concepts and skills. (Minsky, 1990, p. 233)

Some scientists may not be aware of "how they get their ideas", but Einstein thought in visual imagery first, followed by words, explains Miller (1995), a process
similar to the way in which Miro thought: "I begin painting and as I paint the picture begins to assert itself, or suggest itself, under my brush... The first stage is free, unconscious ... the second stage is carefully calculated" (Miller, 1995, p. 190). Instances of this experience are discussed in Chapter 11.

Bunt hypothesises that scientists create new knowledge by finding out what was already there but not already known, but that artists create something that did not exist before. He nominates Einstein's theory of relativity as an example of scientific thought, and proposes that if Einstein had not existed, it would not have been long before someone else developed the theory of relativity. In contrast, Bunt proposes that if Beethoven had not existed, the 5th Symphony would not have been created. Bunt points out that Kuhn also postulates that most scientific investigations are waiting to happen and that developments are triggered by a paradigm shift or revolution in thinking. As stated above, Bunt predicts that an observant scientist can precipitate a serendipitous moment. The development of the first double helix model for DNA is a further example: although Watson and Crick published their work first, other scientists, such as Franklin, were already discussing such a model.

Bradshaw" (2004) speculates that fraud in reporting scientific research is on the increase and affirms that the pressure to publish is a contributing factor which also affects creativity.

If the foundations of observational facts are faulty, the whole edifice [of science] can collapse. And there, nowadays is the rub: administrators, an accursed bean-counting tribe which has escaped the confines of corporate big business to "manage" the creative process of scientific inquiry (an oxymoron, if ever there was one!) now seek to impose quantal values upon its "products" (another misuse of language), the research papers publishing the findings. (Bradshaw, 2004)

Scientists are not the only group affected by the new managerial attitudes, and artists are among those whose creative processes and products are subject to the imposition of quantal values by the new regimes emanating from institutions and corporations.
A new philosophical construct of the ‘two cultures’

In relation to problem seeking, contrary to C P Snow’s (1993) notion of two cultures theory, Nicholls envisages “science and art not on a straight line with scientists at one end and artists at the other end but as a circle.”

I think that theoretical scientists go so close to theoretical artists that, if you had a long line of theoretical science through to practical art, up to the real esoteric art, it would not be one long line with them at either end. Actually, I think they join in the middle with the two theoretical ones, and that the theoretical science overlaps the theoretical art and philosophy which is problem seeking. (Nicholls)

Does technology drive creativity in art and science?

Technology as tool

Benjamin sees technology as a tool; it is “not the voice”, and it is up to the artist to choose which tool to use to allow the voice to manifest itself. Clancy agrees and elaborates: technology is not driving art or science but it is a “two-way split”. In her view, artists respond to new technology, and scientists instigate new developments when they need new ways of working. Clancy adds that, ranging from “a piece of rock” to the latest advance, whatever technology the artist adopts, it does not change the creative drive of the user.

Clancy borrows from Munster to support her view that “science and art are constantly being reinvented” through the availability of fresh technologies. The reinvention of science and art through new technologies, that Clancy asserts, satisfies the conditions for a dialectical process. Munster prefers the term hybridisation to collaboration to describe “flashpoints” when science and art are temporarily aligned due to technological innovations:

drawing from the work of Bruno Latour who argues that the technical object creates a network of meanings as it meanders across disciplines and boundaries, producing itself as a hybrid of natural, cultural, aesthetic, and scientific spheres. Technical objects, especially in contemporary culture, are produced as in-mixing of biological, political, social and aesthetic spheres. In turn, the variable borders between science and art, nature and culture, technical and human, are themselves re-drawn through these historical, processual [sic]
networkings such that they may be variously opposed or brought into relations of conjunction. (Munster, 2001, pp. 19-20)

Artists involved in the new networks around technology have had input into the upsurge in available techniques and technologies, declares Castleden. The advent of these new technologies has been "fantastic" in that it has provided opportunities for the opening up and expanding of artistic practices, but Castleden does not believe that technology is driving what art is about. Nevertheless, she reports that some students complain that it may take weeks to learn a new computer software programme to achieve a mediocre result, to which Castleden responds that "it may take someone else years to learn how to make a paintbrush do what it does with the paint and the medium". However, Castleden detects a correlation between art that is totally based on technology, and that critiques technology, and painting that is about painting, that critiques itself and is self-referential; work which she does not find challenging or engaging. In her own practice, Castleden uses a digital camera, digital imaging, and the internet, as tools to aid her research but the technologies do not define her art. She concludes that, although many artists engage with new technological developments which offer new realms of investigation, commentary and critique, they have retained their innate creative processes.

Piccinini expresses similar views in that technology has provided her with new tools, but it has not changed her creative process. Similar to Castleden, she defines work that is solely about technology as lacking in engagement. In computer based work, Piccinini's preference is for a product that addresses aspects of human life but in which the technology becomes invisible.

According to Cregan and Scanlon (2004), the separation between the artist and the manufacture of her creations, due to her contracting technical experts to realise her ideas, leads to a "disjunction between her work and its subject matter... Piccinini is, ironically, as abstracted from their creation as are scientists from the social consequences of the biotechnologies they develop" (p. 38).

Catts observes that Piccinini's work deals with similar issues to that of the TC&A but from a "fantasy perspective". For Cregan and Scanlon, this perspective is a "cute-reflex" (2004, p. 38). Timms (2004b) argues that Piccinini's The Young Family establishes a communication with the public because it is not didactic and inaccessible, nor is it elitist. The work has "inventiveness and [a] sense of fun" and
these lead to "thought and contemplation", he claims. However, Timms also asserts that Piccinini's work "takes the new and unfamiliar, then normalises them by fitting them into the fabric of what is known.... By that means, it helps us to overcome our fear of the new" (p. 172). The 'normalising' of the unfamiliar is raised in the discussion of the role of artists with biotechnological practices, as some participants express concerns that work that illustrates does not critique the new developments, and could encourage complacency rather than debate within the community.

Bunt queries whether science is just providing the artist with new materials with which to work; for example, a move from working in stone to working in cells. Most professional artists are aware of the interaction between the concept and the form of expression. As Stiles (1996) says, "Like law, art and science concentrate on the definition and redefinition of form in order to chart justice, truth, and value" (p. 364). Bunt points out that working with cells offers the dimension of an active, growing, art work and artists previously have explored ways to make work in which the art work itself continues to change after it leaves the artist's studio. For example, in 1999, at the Bunbury Regional Art Galleries, Mark D'Arcy exhibited aesthetically composed wall pieces of various metals that had been acted upon by acid. A small aperture in the work, strategically placed, allowed fluid from small containers at the back to seep through onto the front surface gradually eroding or acting upon the metal facade.

Meikle also does not agree that technology is driving art or science but is aware that there is a danger that that could happen. A way to keep that possibility "in check" is "to recognise that technology is really just a vehicle". The scientist can use technology as "a vehicle to answer the difficult questions that they are trying to address", and, for an artist, "it is really a vehicle to express their ideas or their concepts".

If you make the technology the centrepiece of the art or science, then there is a danger that it might start to actually control what you are doing and to control the creative process.... If technology were in control of what a particular scientist or research group were doing, then, by definition, it is not good science and will not have lasting significance. I would say it would probably be the same for art. If technology is at the core of what artists are doing rather than the art, then it is not
good art, and it is probably not going to be lasting either.

(Meikle)

Nicholls concurs with Meikle and advocates that technology will only drive art and science if it is allowed to do so, and that art and science are fundamentally behind the development of technology, not the other way around. Society should decide which technologies it will pick up and use, advises Nicholls. Technology can be used in an art form, but the creativity in "real art" comes back to the way the artists are thinking, and the message they wish to express, Nicholls remarks. Science and medicine are using nanotechnology to develop small devices that can be implanted into the human body, but she concludes that it is science and society's needs that drive technology, not technology that drives science.

Cleworth reminds us that, historically, technological developments have had a profound effect on western art, as exemplified by the fascination with perspective and geometry during and since the Renaissance. For him, some artists will always want to engage with new and potential discoveries in the language of the fine arts, and Cleworth does not consider the question of whether technology is driving art or science as being significant. Although technological developments have provided new ways to be creative, Cleworth surmises that technology has not altered the fundamental human creative process.

McLachlan suggests that technology enables art but, in accord with Cleworth, he finds that it does not really impact on the creative process. "It is only when a new technology is invented that it is applied, often in lots of ways which were not foreseen, in fact, applications that were unimagined when the technologies were invented." Technology, for McLachlan, is not driving art or science nor does he see it as being creative in itself. Anderson (undated) observes that technologies mediate both art and science, and that "every new medium which technology brings into being refashions the relationship between art and society, ... and the horizons of science, in non-linear ways.”

Zurr implicates capitalist society that relies on newer and newer products, and its concept that progress is the "main thing", in the drive for technology to expand, but she thinks artists are suited to testing and to scrutinising the new technologies, and to raising any questions that derive from new developments. Catz agrees with Zurr, but adds that “the sad thing about the situation is the fact that the force
that drives scientific research is capital and the distribution of it". He believes that the corporations and institutions that provide the funding are inclined to direct their funds to research they think will develop appropriate and profitable applications for them. Here Cats raises a contentious and important issue: he proposes that it is the power structure that controls the directions in which our knowledge is being applied and that it is this structure that should be critiqued and analysed.

I would like to reflect here that the tool adopted, whether it is a new technology or not, is a crucial element in the form of the creative output of the user. In an art practice, normally, that choice of equipment is guided by the creative intent of the artist; given, of course, that it is an ideal world and all options are available. However, creative artists are not limited by technology as they have no rigid framework in which to operate and have the opportunity to problem solve and invent solutions to deficiencies in the equipment to hand. This adaptability is a hallmark of an art practice and another area of creativity where artists develop skills in lateral thinking. As Smith (1988) points out, before the separation of art from the crafts and trades in the fifteenth century, the Greek techne, or ars, referenced art as skill (p. 10).

In his view, the artist as "technical hero" emerged in the latter part of the nineteenth century in response to the death of the artist as "political hero" following the tragic experiences of David, Goya and Courbet (p. 25).

Technology as an influence on art and science

BEAP, 2004, featured complex technology, but, as Blond (2004c) would have it:

This exhibition is well worth seeing for some of the fascinating questions it raises about science. As an art show, however, it is not as successful because too many of the works are dominated by technology. Instead of art using technology to widen its scope and possibilities, in many cases art has been used merely as a way of displaying science. (p. 11)

Kuhaupt asserts that technology has always driven science and art, and art reflects the technology of the times. However, he recognises that the situation is more dynamic and interconnected, and holistic, than his assertion indicates, and he identifies social, political and environmental factors as issues that influence the situation.
Science and technology are not the same thing, asserts Long, despite titles such as Institute of Science and Technology which really mean that they deal with both science and technology. “Science fuels technology and drives it” he posits. Long explains the process as “new scientific discoveries and innovations can become the technologies of the future, and technology is the application of the science into a useful or economic product”. Therefore, “science drives technology, and technology drives science in the economic forum”. Further, Long thinks technology can drive art into different areas and getting away from the simple painting or sculpture of the old days, we can now have completely integrated computer art, or art that is technologically driven by scientific ideas. The randomness, the mathematics of it, can come up with ideas and concepts that can then be integrated with new technologies to present engaging, new forms of art. So, the restrictions of art in the past can be completely opened to a whole range of new arts of the future. (Long)

Anderson (undated) suggests that sci-artists could consider themselves as “simply exploring the boundaries of their domain” instead of considering “themselves as working in science and art”. He also contents that projects on “the ‘sciart’ web site often appear to be firmly in the artist’s domain, patronised by the scientist” who views them as “an interesting application or sideline”. For Anderson, “the medium is the message, and the scientist’s input is frequently not visible other than through its communication by the artist”.

Bunt was brief in response to suggestions that technology is driving art and science rather than vice versa. “Yes. Very much so” he declares. However, Bunt avers that in relation to radical changes in society, science, in the form of projects like the Human Genome Project, and advances in computer technology, is leading the way. These radical advances have implications for personal freedom and the security of information, and are linked to other issues that warrant careful consideration and debate, he says. Although he agrees that artists initiated many developments in the ways computers are used, he asserts that electrical engineers pioneered the technology. Bunt claims there is a danger of irrelevance for art if it fails to engage with contemporary major issues such as developments in science and technology and, to support his argument, he relies on Kac, an artist who works with
new biotechnologies, who believes that painting lost its relevance due to the advent of photography.

Summary

The research data suggests that the skills learnt in the field of creativity are multidimensional and interdisciplinary, and stand to benefit, not only artistic life, but governments, corporations and the wider community. For Florida (2003), technology, talent and tolerance are key ingredients for a creative society.

An interdisciplinary collaboration between art and science enhances the possibilities to blur boundaries, to challenge prevailing layers of understanding, and to discredit the traditional myths of the 'idealised' artist and the 'idealised' scientist. Interdisciplinary postures also increase the likelihood of openness to suggestions of intuition and serendipity in science and other specialities where such matters previously were greeted with scepticism. An educated, 'prepared', mind, that is 'relaxed' and open to lateral investigation and fantasy, is recommended to permit ideas to flow freely, and the concept of the polymath is discussed in Chapter 11.

A consensus among participants on the difference in motivation between the scientist and the artist appears unattainable. Some proposed factors emerge: for example, scientists rely on new discoveries of what was already there but not already known, and the design of new experiments; scientists could benefit from creative approaches in the dissemination of their research data; scientists and artists use different research languages and processes; scientists and artists have similar creative processes but the products differ, that is, art is [usually] seen as a cultural product; scientists and artists both need 'flexibility' to explore issues; collaborations between scientists and artists assist in diminishing prevailing stereotypes and myths; and scientists and artists who take risks are seen to have creative abilities. Perhaps it would be prudent to qualify the last factor with 'acceptable' risks, although even this is difficult in a climate of accountability.

The interviews reveal that artists are apparently more open to taking risks and facing unusual missions in new surroundings than others. For example, the artists emerge as the most likely group to integrate successfully into laboratory
environments, such as SymbioticA, and I speculate here that this could be due, in part, to the majority of artists being adaptable to, and interested in, new technologies.

The majority of participants believe that a new form of technology is regarded by artists as a tool or a vehicle that does not change the creative process itself, and others understand new technologies as a means to reinvent science and art. They also suggest that artists have had input into the development of configurations for new digital technologies, that technology is not creative in itself, and that art and science are fundamentally behind the development of technology, not vice versa. One participant affirms that society should be the arbiter of which technologies will be adopted, but, for professional artists, it is usually essential that the choice of materials, implements or technologies to be employed in the creation of an art work accords with their creative intent.

Bunt comments that, with regard to biotechnological developments, science is 'just providing' new materials for artists; for example, moving from working with stone to working with cells. He may have regarded it as 'just' providing new materials but, in this regard, I detect a dialectical influence. Science, in developing the stem cells, has collided with art in that it has produced a new mode of artistic construction, a hybrid that straddles science and art. Some participants signal that the implications for society of these new materials and new technologies, and the radical changes they could bring, are issues that warrant debate.

Science and art differ in that science accentuates intellectual communication and art accentuates the communication of subjective knowledge, according to Zolberg (1990), but the participants and others identify many similarities. Problem-seeking and problem-solving skills are seen by most as very important to scientists and artists. Another parallel between scientists and artists is their need for the flexibility to explore new territory, their desire to bring about major change, and their endeavour to be the first 'to do something'. Nevertheless, Bunt states that scientists are not 'creating', but that their research is creating new knowledge of what is already there.

Capitalist society's perceived push for consumerism, and the intent of the corporations and institutions that fund research, prompt two participants to recommend that a critique and analysis be conducted of the power structure that controls the directions in which our knowledge is being channelled and applied.
Although Long believes that science drives technology, and technology drives science in the economic forum, Bunt believes that technology is driving art and science. Nevertheless, Bunt warns that art is in danger of becoming irrelevant if it fails to engage with major contemporary issues represented by recent technological advances in science and medicine. Adding to this, Nicholls depicts the relationship between science and art as circular rather than linear, a view different from that held by Snow and others.

Throughout this chapter, it is the scientist participants who have contributed many of the insights into creativity and innovation, and who have instigated the discussion about the ‘discards’. This circumstance is indicative of the manner in which they have been open to collaborative projects with artists. McLachlan, in particular, has been acknowledged with a prestigious award for his innovation in combining art with medical training.
Endnotes

1 Equivalent Full-Time Student Unit.

2 Eakin identifies Robert Cushing as a retired sociologist from the University of Texas, Austin.


4 Katherine Hall is an established artist, lecturer, and a Master of Arts candidate due to complete in 2004.

5 Associate Professor Brad Buckley is currently Chair of the Sydney College of the Arts Faculty Board. John Conomos is the Senior Lecturer, Electronic & Temporal Arts, Sydney College of the Arts, University of Sydney.


7 Mandy Thomas is Executive Director, Humanities and Creative Arts, Australian Research Council.

8 Reported in the Art Association of Australia and New Zealand newsletter, No. 66, July 2004, p. 3.

9 Dr Anthea Hall is a geologist, and my Associate Supervisor.


11 The speakers in Sight, Brain and Modern Art were Donald Hoffman, author and Professor of Cognitive Science, University of California (Irvine); Israel Rosenfield, writer for NY Review of Books, and lecturer at the City University, New York; and Semir Zeki, author and Co-Head of the Wellcome Dept of Cognitive Neurology, University College, London.


13 Professor John Bradshaw, Monash University, Australia.


15 Dr Lloyd Anderson is the British Council's Director of Science, Engineering and Environment, UK. In his position, at time of publication of the essay, he was responsible for setting corporate policy in science, engineering and the environment, and helped to translate global policy into strategies at the regional and local levels. He worked for the Natural Environment Research Council for seven years before joining the British Council and has published over 60 scientific papers and articles.
The problems of the painter are the problems of the philosopher, 
the enigmas of our knowledge of the external world. (Gauss, 1966, 
p. 99)

Introduction

The participants were asked “To what extent do you think philosophical or 
theoretical considerations influence art of all persuasions today?” Art history was not 
mentioned specifically but those interviewees who wished to comment on that area 
were encouraged so to do. Other influences on art practice that are identified in this 
chapter include the convergence of daily life with artistic and scientific endeavours.

The influence of philosophy and theory in art practice

Aristotle was the first to recognise art “as an object of knowledge”, according 
to Agacinski (2000), and thereby to marry art to theory (p. 95). Agacinski’s chapter, 
Theoretical excess: Transformations of painting, concludes that:

theory as a discourse on what is to be seen in painting must not be a 
way of transcending the work to its meaning. It is a discourse which, 
exceeding art as a work (travail et œuvre; labour and opus) 
contributes to its appearance or attests, a posteriori, that art has 
happened. (Agacinski, 2000, p. 105)

Benjamin, who agrees that art with a “sense of meaning” includes 
philosophical and theoretical considerations “in the mix”, maintains that, if the work 
becomes over-burdened with such deliberations, it can become self-conscious. 
According to Gadamer’s obituary, meaning, for him, was influenced by the 
metaphysical ethos in modern German poetry and one of the values of his philosophy
was his insistence that poets “help us to restore the wholeness and spirituality that have been lost to science. Culture is valuable because it shows us truth as a possession and the other person’s voice as its revelation” (Obituary, 2002, p. 12). Because art “is not only a material production but has material effects” in the world, Tilley (1991) decrees as “unhelpful” Gadamer’s persistence with the function of the individual because it rules out the input of the “collective”. Tilley prefers Jameson’s model wherein instead of relating the emotions and apprehensions contained within the art work to the individual, with their “personalized experiences”, the meaning is transferred to a “collective process” (p. 152). These notions have implications for contemporary traditional art, sci-art collaborations, other new media, and the adaptation of art for science communication purposes, because Tilley argues that, in certain circumstances, power accrues to art as a politically active creation. It is the perceived power of art to provoke debate, or dialectical tension, that Catte and Zurr aim to harness for their bio-art installations.

Baudelaire’s contribution to our understanding of art sways Mayne (Baudelaire & Mayne, 1995). “Painting (or poetry, or music) exists in its own right; it has nothing to do with politics (or philosophy, or archaeology), even though in certain conditions it may appeal, in a greater or lesser degree, to a spectator who is concerned with these things” (p. xviii). Many of the participants do not agree with Baudelaire as they believe that, through their work, artists can critique political, social and cultural issues. However, Wilson (2002) is adamant that artists need to be clear about their own theoretical standpoint due to the influence of critical and postmodernist theory in contemporary art discourse. He delineates three possible courses of action for artists who engage with the new technological developments:

(1) continue a modernist practice of art linked with adjustments for the contemporary era; (2) develop a unique postmodernist art built around deconstruction at its core; and (3) develop a practice focused on elaborating the possibilities of new technology. In reality, the work of artists interweaves these approaches. (pp. 25-26)

While Wilson categorises the potential activities of the artist who wishes to engage with new media within three parameters, Stiles (1996) positions the nexus between art and science as follows:
The imagination that pictures, researches, and seeks to engage in the transformation of all substance belongs to the alchemical minds of the scientist and the artist, both of whom approach the philosopher's stone. Scientific formulas and equations have been described as being elegant and beautiful, just as an artist's works may be scientifically informed and technologically constructed. Artists and scientists act in the intersection between the natural and the constructed. Like law, art and science concentrate on the definition and redefinition of form in order to chart justice, truth, and value. (1996, p. 384)

The modern world is "dependent on theory" and so is contemporary art, confirms Weibel (cited in S. Cook, 2000). If it were not, art would become entertainment and artists marginalised in contrast to scientists whose work is "important", he asserts. His comments add another dimension to Cleworth's observations that art is in danger of being usurped by entertainment, see Chapter 4.

People are dependent on the images that are provided by science (on x-rays, on ultrasounds). They are no longer dependent on the images provided by art. Therefore art becomes marginalised because its images lack in necessity. And therefore in order not to be marginalised artists have decided to be part of the entertainment industry. But this is exactly the way they will be further marginalised because the professional entertainment industry knows better than art how to make fun entertainment. (Weibel cited in S. Cook, 2000, p. 4)

A romantic view of art, one that is about feelings and finding the inner self, still lingers and interests conceptual artists, according to Kuhaupt. However, he believes that, in the early twenty-first century, theory and philosophy, from Plato to Postmodernism, are still important tools of examination and are integral to many current art forms. In addition, Kuhaupt perceives that scientific theory is interesting artists more and more, and that scientific theory and theories from other disciplines are becoming part of contemporary art. His assertion emphasises the importance of interdisciplinary co-operation, the opportunities the dialectical processes within these co-operative discourses offer, and links with the themes that weave throughout this research. Kuhaupt comments that the question, What is Art?, is now redundant "because the answer is 'whatever you like'. Obviously you can debate the subject in an art historical and art theoretical sense, but that is about it."

Piccinini submits that the extent of philosophical or theoretical input into an art work will depend on the artist, but, for her, as with Benjamin, it is the events and the culture around her that inspire her art. According to Bunt, the absence or
presence of elements of philosophy or theory does not necessarily correlate to the quality of the work that is produced in either field. He describes as postmodernist the claim that art needs a philosophical or theoretical underpinning to have any substance, but observes that, in some instances, such a justification is essential to provide a framework within which the viewer can comprehend the work. Bunt believes that this situation is mirrored in science based art wherein the meaning of the work needs to be demonstrated to ensure that the sci-art does not become illustration. However, in his opinion, great work is produced that does not require philosophical or theoretical rationalisation.

Regarding the philosophical or theoretical content of her own art practice, Castleden sees links between the results of her academic studies and her work, but acknowledges that an art work that is presented to an audience would not necessarily be “shouting” these aspects. However, in terms of her momentum and engagement with the ideas that she has, and with the problem solving involved in how to express them, philosophical and theoretical debates contribute to, but do not dominate, her practice. Although Castleden does not pursue theory for theory’s sake, she finds that her research for her Masters degree has enriched her art practice.

Zurr regards artists as philosophers and cites Eduardo Kac as an example of an artist who writes extensively about his work and the moral, ethical and social implications of the technologies he uses. Zurr states:

Recent advances in biomedical technologies raise many philosophical questions about life, and options of life, that must be dealt with. One of the ways is by artists suggesting contestable futures and different scenarios, and by raising these issues. (Zurr)

Cats suggests that, in the field of new technologies, art is driving philosophy rather than the other way around, which he considers was previously the case. He notes that

in France, where we recently exhibited our work, the only time the philosophy department of the Sorbonne University was engaged to a large degree with the broader implications of biological technologies in society, was when the curator of the exhibition made a pun about biological art. The response to the pun opened up discussions about the use of art as a metaphor.
to society and the implications of biological technologies in the role of art. (Catts)

Catts says his example also explains why many artists with biologically based practices write copiously about their work as there is no philosophical or art historical framework currently in existence to facilitate critique by people with no experience in, or knowledge of, the field. (Catt's assertion is also referred to in Chapter 5.) He claims that artists have to "invent their own philosophy and to create tangible, evocative objects for the philosophers to pick up on and begin to discuss." Catts suggests that philosophy has stagnated because "postmodernism killed any need" for philosophical discussion and the contemporary focus is on the "individual and the self", rather than the "social context" of developments. As Catts would have it, lack of information and informed debate leads to "ludicrous" public statements in inappropriate situations, and illustrates his point with an anecdote. During a recent visit to France, Catts attended a conference during which

a person was talking about the memory of the cells, and using it as a scientific metaphor. Obviously there are residues in the cells that are to do with the past, but from there to literally call it memory, because the scientific term for it is memory, was not correct because it was not memory as we perceive memory to be. A philosopher stated that is the memory, the cells remember the whole evolution; they remember everything in a similar way to the way in which we remember. That was enough to infuriate quite a lot of scientists who shouted at her. (Catts)

As reported in Chapter 5, Catts and Zurr contend that many sci-art artists are aware that "our belief systems and cultural tools are ill equipped or inadequate to analyse the effect of the new technologies". They argue that we still use belief systems based on old notions of the body and of life, and that these notions are not really helpful to establish informed debate in regard to the consequences of the new technologies to us, as a society and as individuals. In order to generate a new outlook, they believe it is necessary to create tangible examples that would render our belief systems obsolete by confronting people with things they cannot cope with using their existing cultural tools. Catts and Zurr also claim that art is the best vehicle with which to attempt to do this, and this is the reason they think it is important for
artists to engage with the new technologies even if they do not agree with them. Zurr comments that the tension between the known and the new is important to her as it challenges preconceived ideas and provokes thought: “I like the fact that if you are scared of something and you are not sure what, you actually go and check what it is you are scared of and why.” Thus, for Zurr, the exploitation of the tension between the known and the unknown leads towards a deeper understanding and knowledge.

Clancy thinks that, although philosophical considerations do influence art today, contemporary artists are not particularly concerned with theoretical ideas, but with issues that affect humanity and the artists individually.

The world is full of conflict, contradictions and uncertainty, and it feels as though we are on the cusp of some sort of environmental disaster or a change for the better. Due to factors like terrorism, September 11, 2001, the precarious nature of the environment, genetic engineering, and other factors including globalisation, there is a lot of uncertainty. I think that issues such as these make artists concentrate more on philosophical things rather than art theory in their work. (Clancy)

Because many artists “intuit the deep, underlying tensions and issues that are percolating through our culture and society at any one time”, Cleworth believes that conceptual, philosophical, and theoretical considerations do influence art today whether it is “overtly or intuitively”. He suggests that a bias towards “an intellectualised approach to art making” in art education, art galleries and other public systems, “and the way the work is discussed as well” in the early twenty-first century, is partly a cyclical mind-set. Looking back, he reminisces that some of his former teachers “talked about the 70s as being the period when there was mostly talking being done and very little art production”, apparently a common experience throughout art schools in Australia during that time. In the 1980s, Cleworth says, “we saw that period of so-called return to painting ... it was about getting paint all over you.”

Because Edmondston perceives a wide range of both values and approaches in art and science practices, and because she has not had a great deal of interaction with artists, her assessment is that, for some people, theoretical or philosophical concepts are paramount to their practice, but others “will see art just as a job and
a means of making life a little bit easier for them in terms of income.” The notion that the income from an artist’s practice is a worthy factor for consideration is not supported by the research, titled Don’t Give Up Your Day Job, conducted for the Australia Council (Throsby & Hollister, 2002).

Philosophical issues are very important for contemporary art that is at the cutting edge because “artists are always trying to engage the public to face or confront issues that are controversial” declares Long. Artists need to be well informed about issues and to research the philosophical, cultural, social and ethical matters or the artwork will be shallow. According to Long, “good art is always deep, and engaging, and subtle.”

Meikle surmises that art has a long history of being linked with philosophy and theory, and that art that engages with the big philosophical questions of the day is likely to be the most provocative, and even, possibly, the most successful. His views support those of Bunt who claims that art will become irrelevant if it fails to engage with contemporary issues.

McLachlan asserts that, in science, by the time a theoretical description of something is available, the evidence is in: “theory is part of retrospective rationalisation and not part of the discovery and exploration”. He also suggests that, for artists and scientists, philosophy can be quite remote from practice. As an example, he claims that Karl Popper had “a big influence on other philosophers, but that his ideas are irrelevant to the practice of science and had absolutely no influence whatsoever on scientists.”

Philosophical and theoretical considerations influence art of all persuasions today enormously, and this constitutes a reflection of where society is, asserts Nicholls. “The ability to engage with philosophical and theoretical issues is directly correlated with our ability in society to create art”, states Nicholls, who then goes on to speculate that there would be "very little art and philosophical discussion going on in Iraq at the moment". Nicholls is fundamentally correct about the situation for artists in Iraq in 2003. During the 1990s, Vincent (2004) reports, Iraqi artists did quite well, one testifying that he had “over 100 commercial shows from 1992 to 2002”, embassy personnel and tourists being his main purchasers. Since the coalition’s invasion, sales have slumped, many art venues are
inaccessible, and artists are finding themselves flung into the maelstrom of an international art scene, the wiles and works of which are difficult for them to address. Vincent notes that one Iraqi artist remarked: “First we have to discover our identity. Before, Saddam told us we were Arabic Muslims. Now he’s gone, and we have to open the door to ourselves, to learn who we are and what it means to be Iraqi” (2004, p. 93).

Cultural theory and art

The participants’ comments prompted me to examine recent texts that question the value to art students of some of the theory taught in tertiary art departments. In his summation of a symposium in 1990, Sandler decides that art theory has become problematic.

Art theory had become, in a word, academic, and indeed, it remained influential only in graduate art history programs, in which unregenerate tenured ideologues taught that scholarship meant choosing and mastering a dogma; poking through works of art for evidence supporting it; and evaluating the work on the basis of the dogma. (Sandler, 1996, p. 546)

Eagleton’s After Theory², 2003, is welcomed by Slattery (2004) as validation of his recent challenges to the dominance of French twentieth century theory in Australian academe (p. R40). Eagleton’s reassessment of cultural theory is also timely for Timms (2004b) who asserts that “most university art schools teach art theory based on cultural studies rather than art history”. He decries the recent neglect of art history, which, according to Timms, is usually invoked currently only for its “dialectical uses” to demonstrate “contemporary relevance” in relation to “realism and transgressiveness”. Timms postulates that “theory is didactic, generalising, and self-contained. It does not encourage – it actively discourages – intimate emotional engagement with individual works of art” (p. 28).

Robert Dickerson, the sole surviving artist of the Antipodean group, maintains the view he first expressed in the 1960s, that: “The theory of art is absolutely absurd. No such thing” (Bannerman, 2004). The Antipodean Manifesto, penned by the art historian Bernard Smith, and signed in 1959 by Charles Blackman, Arthur Boyd, David Boyd, John Brack, Robert Dickerson, John Perceval, Clifton
Pugh, Robert Dickerson and Smith, defended the tradition of the figurative image in art (B. Smith, 1988, pp. 193-197).

However, independently of the education system, and as he moved from one form of expression to another, Robert Irwin recognised in his art practice the need to situate “what I was doing in any kind of historical or philosophical dialogue”, and began with Hegel (cited in Sobchack, 1993, p. 72). Irwin regrets that “our society has come to see philosophy as a discipline instead of as a way of going” (cited in Sobchack, 1993, p. 122).

Summary

Art’s function as an instrument of discourse and of critique of political, social and cultural issues is enhanced by a knowledge of theory and philosophy, according to several participants. Others invoke a caveat that art work overburdened with these elements often becomes self-conscious and inaccessible. That aside, it is suggested that artists need to be aware of their own theoretical standpoint due to the influence of critical and postmodernist theory on contemporary art discourse.

Another view is that art not supported with theory could be classed as entertainment in contrast to the work of scientists which is regarded as important. However, science and art share one common philosophy, according to Stiles (1996), in that they both contemplate their use of form in their engagement with issues of “justice, truth, and value” (p. 384).

An over-arching idea that materialises out of the interview data relating to philosophy and theory indicates that, whether it is an artist or a scientist, it is the individual response that is significant. These responses are inspired by the events and the culture experienced by the artist, and by the issues facing humanity as a whole, and the absence or presence of philosophy or theory is not a gauge of ‘quality’ in the work. It is also pointed out that some viewers may need a theoretical framework to provide a context for challenging art, whether traditional or science based, to enable them to comprehend the work. The use of didactic panels is further discussed in Chapter 11.

Another view espoused by a participant is that the advent of, and wide engagement with, new technologies is driving philosophy, rather than philosophy
driving contemporary attitudes. The alleged lack of pertinent philosophical or art historical framework for biologically based art is given as the reason artists active in sci-art feel the need to write copiously about their work. In addition, Catts and Zurr contend that current belief systems and cultural tools do not equip society to analyse the impacts of new technological developments on the community. Zurr also comments that the tension between the known and the new is a zone that she finds challenging to explore, and that that exploration can lead to greater understanding.

Some participants emphasise that philosophy is more relevant to them than art theory. The majority of artist participants graduated from university during the 1980s and 1990s, a time when French theorists dominated cultural discourse, and this could contribute to their apparent accord with the views of Timmis (2004b) and Slattery (2004) who advocate a greater emphasis on art history. Nevertheless, earlier theorists, such as Raymond Williams (1965), indicate the important influence that cultural and social contexts have on societal relationships. It is interesting to posit here that a contemporary cultural and social context that is more amenable to interdisciplinary activities between people working in art and science may have facilitated sci-art collaborations to develop. Overall, from the participants' attitudes, it would appear that both philosophy and cultural studies are necessary to move towards a reassessment of our current belief systems, and that this approach may precipitate a more interdisciplinary engagement.
Endnotes

1 Peter Weibol is the Chairman and CEO of the Zentrum für Kunst und Medientechnologie in Karlsruhe, Germany.

CHAPTER 10

AVANT-GARDE: TODAY?

Avant-gardism might haunt contemporary art and criticism, but it is no longer
the stage of contemporary practice (McLean, 2000, p. 47).

Introduction

Question 9 asks participants whether they consider the term avant-garde applicable
to any contemporary art practices and, if so, which practices and how. The
question was prompted by the proliferation of recent texts debating the relevance of
the term avant-garde in current art criticism: some of these texts are cited in this
chapter. I did not mention the words ‘technologically’ or ‘conceptually’ to the
participants as I did not wish to either restrict or target their thinking. Although the
limitations of the research prevent an in-depth analysis of this area, I posed the
question, nevertheless, to gain an insight as to whether or not the participants view
their own work, or the work of sci-art collaborators, as having some of the qualities
generally associated with the term avant-garde. Although several participants agree
that the term avant-garde could apply to certain contemporary art practices, their
reasons differ. Once again, however, the responses highlight the diversity of opinion
and variety of subject matter the participants proffer in answer to the same question.

An earlier notion of ‘avant-garde’

Taylor (1987) sets the backdrop. He introduces the avant-garde of the early
twentieth century as one that was

aware of the “new” philosophical positions of Nietzsche, Schopenhauer, Hegel and Bergson, and that sought to find in these a
new means of opposition to the “normalised” life of the bourgeois
middle class. Whether it was despair, erotic decadence, the illusions
of perceptual reality or the forces of alienation and the hypocrisies of
bourgeois life; it virtually defined this avant-garde to see itself and its supporters as custodians of these philosophies. (p. 23)

Huyssen (1980) explains that political as well as philosophical and artistic radicalism were features of the avant-garde in the early decades of the twentieth century. Since then, however, “Like a parasitic growth, conformism [including political, institutional and academic] has all but obliterated the original iconoclastic and subversive thrust of the historical avant garde of the first three or four decades of this [twentieth] century” (1980, p. 152). Pointing to a hidden dialectic between avant-garde and mass culture, Huyssen perceives that Walter Benjamin’s notion ‘of a [possible] historical change in sensory perception’ occasioned by the new technologies, and changes brought about by city living and capitalism, could be one of his “most interesting and yet undeveloped ideas” (1980, p. 163). This hidden dialectic, prompted by a change in sensory perception, relates to Chapter 11, in which the possibility of an artist’s ability to see ‘gold’ in the discards of others is discussed.

Moving forward, theorists such as Krauss (1985) contend that the concept of the avant-garde, predicated on notions of self-birth and originality, and even the possibility that any late twentieth century art could be considered avant-garde, diminished with the advent of Postmodernism. Her comments about the grid and its adaptation by artists who were considered avant-garde are known to most students of art. Gleeson (2002) adds weight to Krauss’ claims later in this chapter. Willett consigns the term to the status of an anachronism (1999, p. 60). However, whether any contemporary art meets the requirements of avant-garde is a quandary that rests, for the moment, in the realm of art criticism rather than art history, the latter being a discipline that focuses on past art practices, as Smith (1999) points out. According to Betancourt (2002), an art practice that repeats historical avant-garde origins will form part of the basis of the new avant-garde established around “disruptive technology” which, “is basically a form of cultural democracy”. For example, first, the avant-garde “would fall outside the framework of the existing art world” and, second, “democracy, in the form of equal access and availability, is another crucial characteristic of a disruptive technologies model for avant-garde”. He acknowledges that these characteristics will not suffice alone and, in order to radically alter current beliefs and values, and to ensure equal access, he suggests that, as well as addressing
issues about audience, "such an avant-garde would be connected with a technology like the Internet (or a new technology that replaces it, as yet unknown)". Although his ideas relate to both the "artistic and social realms" as required by Nochlin (1991, p. 2) and mentioned in Question 9, I am not sure that Betancourt would agree with my interpretation of avant-garde, or that of my interviewees. His argument posits that equal access and availability is a characteristic of an avant-garde based on disruptive technologies, but this would appear to undermine the notion that an avant-garde concept is cutting edge and, therefore, would presage challenging, new ideas before they became widely available. Equal access and availability are also problematic in relation to bio-art which has the potential to become elitist due to limited access to laboratories and materials, the expensive equipment involved, and the funding required to maintain and promote sci-art collaborations.

Betancourt’s hypothesis that avant-garde practices at the beginning of the twenty-first century would be largely dependent on technological developments, a field on which some of the participants’ art practices rely, is moved to a more rigorous level of debate by Rutsky (1999). The latter agrees that technology has been central to cultural shifts in both Modernism and Postmodernism, and extends his discourse to recent developments in nanotechnology and cyborgs. He also contends that style and aesthetics are important to "avant-garde" and "state of the art" high tech, but that these elements have been overlooked, as have many of the cultural implications of technology. These elements, which impinge on the practices of some of the participants, are less concerned with changes in technology, and more concerned with "the very conception of technology, of what technology is" (p. 1).

Other grounds for scepticism of "avant-garde" rhetoric of high tech include:

If the rhetoric of the modernist avant-gardes served to distinguish an artistic vanguard from the rest of the population, the notion of a high-tech avant-garde privileges a "highly technological" vanguard that is also, often, "highly capitalist". Yet, one crucial similarity that high tech does share with the modernist avant-gardes is that in both, the conjunction of the technological and the aesthetic is a central concern. (Rutsky, 1999, p. 5)
Issues of controversy and assimilation

In his analysis of post avant-garde views, McLean (2000), an art historian, situates avant-gardism as "a metaphor for a revolutionary posture. Today it describes a general mentality considered characteristic of, and even essential to, contemporary art, whatever its content or style" (2000, p. 46). Although McLean's claims for a prevalent 'revolutionary posture' are in line with those of some of the participants, not all the participants are convinced that avant-garde is essentially applicable to art practices today.

McCulloch (2003) conflates the term avant-garde with contemporary. In her comments on the Clemenger Contemporary Art Awards for 2003, she advises her readers that the annual Joan Clemenger $30,000 endowment is for "the purchase of avant-garde Australian works" and that awards like the two Clemenger endowments "are significant in raising the profile of avant-garde art. The only quibble I have with this year's award is the definition of contemporary, which in art terms has come to be a synonym for avant-garde" (2003, p. R21). I have been informed that the terms of the Joan Clemenger Endowment specify 'contemporary art' and that the term 'avant-garde' is not used (J. Smith, personal communication, July 26, 2004). The entries in the Clemenger Contemporary Art Award, 2003, ranged from bark paintings (Mawumdjul, winner), a bikini car (Stelarc), to photography and painting.

Cleworth contends that the notion of the avant-garde has been incorporated into the marketing and hype surrounding art practice in the twentieth and early twenty-first centuries to such an extent that he doubts whether contemporary fine arts do actually function as avant-garde. He hypothesises that work that appears as radical is quickly subsumed within, or its radicalism is dissolved by, society. Cleworth cites Juan Davila, whose work is highly politically motivated and cutting, as an example of an artist who "talks about maintaining a strong critical edge and criticises the art world for not being political enough" but who exhibits his work within the gallery system; a circumstance that makes it difficult for Davila to be seen to maintain a critical function. The dilemma for political or critical artists of whether or not to exhibit within the institutional gallery system is complex. Alternative spaces, such as artist run spaces and other, more unorthodox, venues can bring their own problems: for example, lack of infrastructure, poor location, lack of recognition as a serious venue, low audience numbers, and a lack of interest and critique. However, if
artists do not exhibit their work, they are unlikely to receive reaction and feedback, critical or otherwise. Cleworth's view is supported by Hooker's (2003) reflection, in the latter's critique of the texts of Adorno, that "generations of radical artists have been tormented by the effortless assimilation of their works, ideas, gestures and personalities" (p. 6). These concerns are not new. Gombrich notes (1995, p. 622) that artists of the mid-1960s found that there was little left to be defied once their anti-art "became art with a capital A". Gleeson expressed similar thoughts in the "Sun", in May, 1964.

But what happens when the time lag between what the avant-garde considers unacceptable, and therefore worthy of its attention, and its acceptance by a wide section of the public is so small that it is hardly discernible? What becomes of a rebel whose cause is so immediately accepted that it cannot be recognised as a rebellion? At this point, rebellion merely becomes a change in fashion. (Gleeson, 2002, p. 20)

Haacke's career is typical of that of an artist who has adopted a revolutionary posture in their work (see Chapter 4). He is one of many radical artists who were vilified, and then embraced by the gallery management, thus anaesthetising the audaciousness of their installations. Nevertheless, some of Haacke's exhibits have caused furors. Mann (1991) enters the debate about the recuperability, or 'rehabilitation', of Haacke's work, declaring that

any antithetical art that succeeds in the artworld is a failure; Haacke's political art is attractive to certain established sectors of the artworld, ergo he has failed. He has been recuperated, and because he is recuperated he is ideologically dead. (p. 126)

A combination of granite, uranium and sculpture brought the radical work of James Acord to the notice of USA officialdom. Acord's practice is unique. An artist as a nuclear power? Acord's story is stranger than fiction. By an amazing set of circumstances too complex to relate here, Acord, a sculptor who works with granite, and who was endeavouring to progress his art practice in the USA, eventually took graduate level classes in nuclear engineering to obtain a licence for a nuclear site. In particular, he now enjoys arriving at meetings at the Nuclear Regulatory Commission, Washington DC, with his licence number tattooed on the back of his neck: "WN means Washington, 10 means uranium, 407 that's the 40th licence
issued, and the dash one means I only have one location” (Acord, 1998). Acord is the only private individual to hold a licence for a nuclear site.

*Piss Christ* stirred religious controversy in Australia when it was exhibited at the National Gallery of Victoria in 1997. In Moscow, controversy surfaced over an icon with a large hole in place of the head of the subject to enable visitors to place their own heads in the void, and a Coca-Cola logo with the face of Jesus drawn next to it and the words “This is my blood”. The exhibition, Caution: Religion, opened in January, 2003, but was closed after four days. The more than forty artists who exhibited came from Russia, Armenia, Germany, Georgia, Cuba, the USA and Japan. Pravda (2004) reports that Yuri Samodurov, head of the Sakharov Museum Moscow, with Ludmila Vasilovskaya and Anna Mihachuk, have been convicted of inciting hostility towards religious believers, a conviction that could bring up to five years in prison or a fine of up to $22,000, but the case has been sent for “reinvestigation”. Shmidt (2004), a Counselor-at-law in Moscow, expresses concern about the growing power of the Russian Orthodox Church in Russia and notes that steps are under way to require the teaching of Divine Law in schools and “to punish disrespectful treatment of Church symbols according to the same article of the Criminal Code as state symbols”.

Appropriation of images of poverty

Copying the clothing of the poverty stricken and selling it as grunge expensive clothing is another practice which Benjamin speculates derives from the contemporary avant-garde. His view coincides with that of Cleworth who refers to the appropriation by large corporations of items of clothing worn by, for example, “so-called street kids”, which in some cases are examples of quite radical reactions to social conditions of the time, and the subversion and marketing of the items of clothing as “up-market” goods. However, the initial tensions this appropriation of ‘protest’ clothing generates soon dissipates, and the products are subsumed into the mainstream, a situation that parallels that of ‘protest’ art, such as the work of Haacke. Benjamin’s and Cleworth’s assertions are pertinent in light of the manner in which art magazines have recently featured fashion as art (see Chapter 4). United Colors of Benetton, a fashion clothing, sporting goods, and F1 racing company based in Italy that appropriated aspects of “street” life, admits that its advertising campaigns have
frequently met “strong” and “ferocious” reactions. Benetton appears to have attempted to ameliorate this criticism by featuring the company’s cross cultural attitude to staff selection, its support for “the creative development of young artists/researchers”, plus its cultural activities, including a museum and library, on its web site (United Colors of Benetton, 2004). However, arguably the ‘united colors’ of Benetton’s organisational structure could also be viewed as a marketing tool.

As C’ney would have it, Cubism transformed society, but today, advertising, with its access to mass media and money is more likely to be the medium to subvert society. Berger (1972) presages this and proposes that publicity, or advertising, encourages the view that people can “transform” their lives by “buying something more” (p. 131). Further, he indicates that publicity subverts society by turning “consumption into a substitute for democracy.... And it also masks what is happening in the rest of the world” (p. 149).

Avant-garde, today?

Meikle proposes that “there are a lot of things in both art and science that are cutting edge, but are not necessarily avant-garde.”

Attributes previously considered applicable to the avant-garde artist included “revolutionary, dandy, anarchist, aesthete, technologist, mystic” and “originality” (Krauss, 1985, p. 157). The necessity for some of these attributes lingers today, according to many of the participants. Timms (2004b) questions the current use of the word ‘contemporary’ as indicating “modem, up to date, and fashionable” and, in the art world, indicating “authority and style”. This, he claims, is a means of “avoiding the term ‘avant-garde’, with its unacceptable overtones of linear progress, while at the same time retaining the competitive edge that ‘avant garde’ confers” (2004b, p. 18).

Avant-garde or contemporary art practices cannot subvert society today, according to Clancy, but “terrorism, destruction, and war” are among those events that can. At a time when the world is subject to tragic and shocking events, such as global terrorism and suicide bombings, Benjamin is surprised by the attention work such as Tracey Emin’s “middle-class nonsense” attracts. If such work is considered avant-garde, Benjamin questions its relevance to society. Another
instance of an avant-garde practice, in Benjamin's opinion, is the creation of deliberately abstruse art work which, by its own definition, excludes others who are not part of the art cognoscenti. If an aim of the avant-garde is to subvert, then Benjamin is sceptical if one can subvert the masses by confusing them.

The term avant-garde only applies today to art that is socially threatening and engaging, claims Long. He explains that by threatening, he means art that challenges the audience's religious or cultural beliefs; for example, the exhibition of *Piss Christ* in Melbourne in 1997.

If one views avant-garde as challenging, then Clancy nominates the work of Cats and Zurr, such as *Worry Dolls*, which she sees as being "on the cutting edge of the aesthetic avant-garde", and as a practice that has the "potential to challenge in different fields; social, artistic, and scientific".

Interpreting avant-garde to mean "in front of the normal, leading", Bunt recognises that science, technology and the media have leapt ahead since the 1960s and 1970s. He rueis the fact that an item about sci-art and bio-art will be included in news bulletins, not as the headline, but as the droll item to close the report. The political, commercial and technological stories take precedence. Bunt remarks that commerce places a very low value on art, but that many multimillionaires who wish to leave their mark behind invest in art and/or endow an art gallery in their own name.

Catts declares that, because "the biomedical field is creating a lot of fundamental and important philosophical and ethical questions, bio-artists must engage in the broader social aspects of these developments", and, from this premise, he proposes that artists with biologically based art practices would qualify as avant-garde. He qualifies this assertion by stating that some artists who deal with aspects of the biomedical field are not avant-garde; for instance where the artist is co-opted to promote a corporation's products to "entrench the current power structures". In other cases, if artists want to be part of the bio-art scene, they need to be subtle in their approach to funding bodies or they are not given the necessary access and, as a result, the work is not challenging or avant-garde. This could occur where the funding body is apprehensive that the artist's intentions are critical rather than supportive of that body's activities. Another argument Catts and
Zurr mise is that, prior to the extensive exposure of the public to propaganda, "from advertising to political, art that was selling an idea directly was seen as appropriate". In 2003, "people are much more sensitive, and effective art should be much more ambiguous; the art that raises the question rather than providing the answer in your face" states Catts. Nevertheless, Catts admits he would like to believe that their TC&A project can be seen as avant-garde.

If one takes a definition of avant-garde to mean those who are "out in front", and who break new ground, then, by definition, it still has to exist, says Nicholls. She nominates the Worry Dolls as an example of work that could be called avant-garde because it challenges how we use tissue culture, the ethics surrounding its use, and the concept of what is a "living thing". In relation to the notion of alienation or disaffection with society, in Nicholls' experience art created with this ethos is not "very effective", it does not "go anywhere". In contrast, the biologically based art is disturbing, but slightly intriguing, and has a connotation of being engaged with society's issues and debates. One disturbing aspect Nicholls identifies is that, if celebrity artists make art that is dismissed by the public because it does not really engage or challenge them, other contemporary artists are impacted by this attitude because people generalise and decide they "are not interested in modern [contemporary] art", they do not attend exhibitions of new work, and damage accrues to all contemporary art practitioners. Nicholls has located a notable discord. The practices of artists, such as Haacke, Emin and Serrano, could result in the alienation of the very public with whom they are endeavouring to form a dialogue, a situation that, by association, is extended to other contemporary artists.

If avant-garde is linked with subverting society, Edmondston does not equate the work of Kac, Catts, Stelarc or Piccinini with avant-garde and, in some cases, her reaction is that the work is quite tame and not particularly original. However, she suggests that if they had chosen different applications for the technologies they are using, the work might have been considered avant-garde. In Edmondston's proposed collaboration, which she describes as art for art's sake, the team does not wish to project any particular political agenda or message, or to be controversial.

Meikle judges the question about the avant-garde as "intriguing" and, although he surmised that avant-garde art means something that is subversive, has a shock factor, and "really jars against your instincts a little", he compares that with
avant-garde music which is not necessarily "jarring". Asked whether he regarded Payne's work (see Chapter 3) as avant-garde, Mcikle responded that the public is not used "to seeing inside the body" so, in that sense, perhaps her work is subversive and radical. Although he hasn't seen an installation by Cats and Zurr, Mcikle submits that this work could also be categorised as radical as the public is not used to seeing "a living biological process" or attending a "dying ceremony" for the exhibits. Nevertheless, although he observes many things in art and science that are "cutting edge", Mcikle does not consider them "necessarily avant-garde".

Along with Mcikle, and although she is aware of artists who are constantly pushing boundaries; for example Friedman's 1,000 Hours of Staring, Castleden is not convinced the use of the term avant-garde is warranted. Castleden deplores categorisation and, when asked about the avant-garde, responds that, for her, engaging art always pushes boundaries and pioneers new ideas.

Von Hagens' 'art work', mentioned by Nicholls in Chapter 11, pushes boundaries, as does that of Damien Hirst and others that could be construed as desensitising the community to acts of violence against humans. A documentary about extreme art in China shows images of Zhu Yu, a Chinese 'artist', who washed a stillborn baby and then consumed it, the photographs being publicly displayed as art. The documentary also "features a man drinking the wine used to preserve an amputated penis" (Botum, 2003, p. 14). As Botum relates, instances were previously reported of the Shenzhen Health Centre for Women and Children distributing "bottles of thumb-sized aborted babies to be made into meat cakes or soup with port and ginger", so, in Zhu Yu's case, is his art not avant-garde or shocking, but also trailing behind 'normal' practice? The point Botum makes is that, if practices such as those mentioned are permitted to proceed without abhorrence, and if Peter Singer's suggestion "that a baby is less important than a pig and that we ought to have a 28-day trial period before we decide whether or not to let newborns continue living" goes unchallenged, then we, the public, could become inured to problematic practices. Botum's unease is precipitated by the following events: the perception that Singer's position as an ethicist at Princeton University could make "the slaughter of the innocents a debatable moral question rather than an undebatable moral principle"; the claim by the Raelians to have delivered a 'cloned' human; and the establishment of the Stanford University's $US12 million research centre "that
would deliberately create cloned human fetuses in order to destroy them for biomedical research" (Bottom, 2003, p. 14). A problematic issue for humankind is the broadcasting of television footage of the beheading of hostages by terrorist groups. Artists will find it very difficult to "shock" and "challenge" in light of the real life brutality appearing on television screens. In light of acts such as these, which impinge on the role of the artist at the beginning of the 21st century, Carroll questions "Where is our capacity for spontaneous and unselfconscious revulsion?" (1993, p. 232).

Timms (2004b) reports that, in the early 1990s, a study indicated that contemporary art collectors in France frequently purchased art work that disturbed, shocked and even 'assaulted' them (p. 77). The discussion in Chapter 4 highlights the re-emergence of beauty as a factor in art from the mid-1990s onwards.

Ugly and shocking art has "clear precedents in the Western European canon", Freeland (2001) reminds us: Goya, for example (p. 28-29). Through their perspicacity as painters, Goya and Picasso still shock and challenge audiences today with their images of the brutality humans inflict on their fellow humans; for example, Goya's Disasters of War series, 1810-1820; and Picasso's Guernica, 1937. Their ability to achieve this result with paint demonstrates that conceptual and artistic skillfulness can render a resort to dubious practices unjustifiable.

Negative connotation to the term 'avant-garde'

Although the idea of subversion is strong for both science and art, the difficulty for McLachlan is that it seems to him that the term avant-garde has acquired a negative cultural interpretation. He suggests that "people are often slightly disapproving" of something that is described as avant-garde. McLachlan is supported in this view by Strom* (2004) in her advocacy for the term 'political culture' in preference to avant-garde. She claims that "overtones of derision" have become associated with avant-garde since the rise of postmodernist theory (p. 47).

Summary

The patterns that have emerged from the discussion of avant-garde indicate that the term is well understood by members of both disciplines, despite the
assertions that the term has fallen from favour; that avant-garde has become conflated with 'contemporary'; and that the possibility of a radical avant-garde practice has diminished during Postmodernism. Technological developments, such as access to mass media and the internet, that have facilitated the speedy dissemination and assimilation of new ideas, have contributed, in part, to this diminution. However, Walter Benjamin (cited in Huyssen, 1980, p. 163) posits the notion that the changes in daily life, brought about by capitalist society's rapid immersion in new media, particularly during the second half of the twentieth century, could prompt a change in sensory perception, a change that would reflect a dialectical process. That may be so, but Betancourt (2002) cites democratic access as one of the key characteristics of "a disruptive technologies model for avant-garde". In the case of bio-art, the availability of democratic access is debatable due to the costs involved and the limited opportunities in laboratories for artists.

One consequence of the wide availability of new technologies is the swift assimilation of new ideas. This rapid assimilation, and the manner in which notions of the avant-garde have been appropriated by commerce for marketing purposes, are proposed as grounds for the perceived rapid subsuming of radical art work into the routine. If being avant-garde is linked with radicalism and subversion, one participant suggests that advertising is a more likely medium to subvert contemporary society than is art. She proposes that access to the mass media and large amounts of capital outlay enable advertisers to suggest to the public that certain purchases will transform their lives quickly and easily.

A number of participants suggest that cutting edge work is not necessarily avant-garde, and that the historically linear concept of avant-garde is no longer appropriate. On the other hand, it is the new technologies that facilitate the development of biologically based art practices, and "semi-living" sculptures, that many of the participants nominate as avant-garde. These bio-art practices incorporate the elements of style and aesthetics which Rutsky (1999) asserts are important to the wider concept of technology. His wider concept also considers social issues and Long, in particular, refers to the possibility that art that threatens religious and cultural beliefs could be referred to as avant-garde.

Two participants flagged the 'irrelevance' of inaccessible work that does not engage or challenge the audience, such as that of controversial 'celebrity' artists,
deemed "middle-class nonsense" by one. Nicholls suggests that the careers of other contemporary artists could be impacted upon if members of the general public assume that all contemporary art is similarly irrelevant. McLean (2000) claims that the spectre of the avant-garde still haunts contemporary art criticism.

The net overall result of the participants' comments, then, is not an overwhelming endorsement of the recognition of biologically based art practices as avant-garde. The Worry Dolls are favoured by Clancy, Catts and Zurr, Nicholls, and Meikle as the most eligible for consideration as avant-garde art in this field. Meikle, when pressed, agrees that Payne's work would probably also qualify. This lack of enthusiasm for the term avant-garde could reflect the diminution of its popularity after the advent of Postmodernism, as Krauss (1985) explains. Therefore, the sci-art collaborators were more likely than the traditionally based artists to consider biotechnologically based work avant-garde.
Endnotes


2 Although Rutsky is aware of Haraway’s cyborgs, and allows that “the future need not be simply ‘human’, need not be predicated solely on the ‘utopian’ politics of human enlightenment and empowerment; other futures are possible, imaginable” (p. 158), it is plausible to conjecture that participants with ‘semi-living’ biologically based practices in this research have already leapt beyond the science-fiction realm that Rutsky depicts in 1999. Rutsky, R. L. (1999). High techne: Art and technology from the machine aesthetic to the posthuman. Minneapolis, MN; London: University of Minnesota Press.

3 Jason Smith is the Curator, Contemporary Art, National Gallery of Victoria.


5 Piss Christ (1989), Andres Serrano. Prior to the exhibition at the National Gallery of Victoria, representatives of the Catholic Church applied to the Supreme Court of Victoria to prevent the exhibition from opening on the grounds that the work Piss Christ was blasphemous. Their application failed and, following the opening, two attacks on the photographic work. In the first incident, a man unsuccessfully tried to remove the work. The second involved two youths who attacked the work with a hammer. The Director of the Gallery, Dr Timothy Potts, closed the exhibition early due to apparent concerns about the security of staff and visitors. Arguably, the reputation of the Gallery was a bigger concern.

6 Tracey Emin has exhibited with the Young British Artists (yBa) which includes Damien Hirst and other controversial artists. Some of their works, including Tracey Emin’s Tent: Everyone I Have Ever Slept With 1963-95, were among many items destroyed in a fire at the Momart storage warehouse in Leyton, east London, early on Monday 24 May, 2004.

7 This formula is frequently adopted by the Australian Broadcasting Corporation’s news and current affairs desks.

8 Dr Strom is Visiting Professor of Art History, Grand Valley State University, USA.
CHAPTER 11

THE ROLE OF THE ARTIST AT THE BEGINNING OF THE TWENTY-FIRST CENTURY

Socrates said that for him the person who discovers and who makes a thing which is invisible evident, is an artist. (Takis, cited in Stiles, 1996, p. 386)

Introduction

In this chapter, the participants locate issues that have implications for both established and emerging artists. Access to research laboratories, and the availability of new technologies and materials, have assisted artists to expand their practices. These, and other experiences, have impacted on the role of the artist and the manner in which art works are created, analysed, and exhibited.

Governmental and institutional views on the role of the artist

According to the Australia Council (1999), the ability to "see things differently", and to "interpret and critique cultural innovation" are qualities with which artists are imbued. The Council anticipates that artists will use these skills in collaborations with science and technology to advance the cause of the 'knowledge nation', and, through exhibitions, to give "people a direct experience of scientific discoveries" (Australia Council, 1999, p. 5). For example, the Council notes the international recognition accorded the work of Catts and Zurr, and their innovative approach to tissue culture processes (1999, p. 10). It states:

Artists are by their very nature different to most people in industry, though less so in areas of science. It is that difference that brings new perspectives, new approaches, new synergies, new understandings. As a community there is a dire need to work TOGETHER to "reposition the artist" [italics added] whilst not diminishing their inherent qualities and abilities. Strong endorsement of the government is
essential to effect the necessary cultural understanding across industry. (Australia Council, 1999, p. 19)

However, the desire to 'reposition' artists could be difficult to achieve if artists are as idiosyncratic as folklore would have it, and, possibly, the very repositioning could be the means of diminishing the differences that the Council extols. Indeed, although at first glance the proposed repositioning may appear to offer opportunities, particularly in the form of government sponsored work and recognition, the possible limitations that could develop include overt or covert covenants on the extent of the critique of government policy the artist can exercise. The government would gain access to some of the benefits of the 'power' attributed to art, but, at the same time, could undermine the power of the artist to exercise that power. This undercurrent of latent issues epitomizes the factors of which Boyatzis (1998) advises researchers to be aware.

Corporate funding and its provenance

As outlined earlier, a discussion of bioethics is beyond the scope of this thesis. However, in a different context, Benjamin refers to the actions of shareholders who are now choosing to invest in companies that are perceived to be operating within "clean and green" parameters, and asks: "Is it the responsibility or role of artists to ensure that the purchasers of their work, or sponsors, acquired the funds in an ethical manner?" The ramifications of such an exercise would reverberate through public galleries, dealer galleries, private collections and art practices across the globe. Benjamin poses this conundrum because he and the other artists on an art expedition were criticised in the Melbourne press for accepting the patronage of a person whose business dealings allegedly had been under question several years prior to the excursion. The criticisms were raised even though the businessman had been cleared of any alleged wrong-doing.

The role of art and of the artist

"Art ploughs a wake simultaneously to other kinds of movements and other world events" (Castleden, see Chapter 6).
Merleau-Ponty (1964) addresses the relationship between science and art, and the differences in the two disciplines' attitudes to vision and perception. In the 1950s, science became obsessed with “absolute artificialism”, according to Merleau-Ponty, but

The painter lives in fascination. The actions most proper to him [sic] – those gestures, those paths which he alone can trace and which will be revelations to others … to him they seem to emanate from the things themselves, like the patterns of the constellations. (1964, p. 157)

Merleau-Ponty’s notion of the properties within the ‘things themselves’, and that perhaps are ‘revelations to others’, could link with the idea that artists are open to examining the ‘discards’ that scientists and others sometimes forego, as discussed below. His perception also parallels Barthes’ (1983a) concept of the Eiffel Tower looking back at the people of Paris (see Chapter 2). In addition, Merleau-Ponty notes the experiences of painters, such as Klee, who have said that they sense that their subjects, including the inanimate, look back at them.

Murdock suggests that, generally, the artist “seems an irresponsible individual. He [sic] may be deeply related to his time and to the history of his art, but he has no given problems to solve. He has to invent his own problems” (cited in Magee & Berlin, 1979, p. 269). Minsky (1990) disagrees. He does not understand artists as being irresponsible but suggests it is more “lack of constraint”.

Then what distinguishes an artist from any other kind of scientist, craftsman, or specialist? Sometimes, surely, nothing at all. And, sometimes, simply, a lack of constraint. (An engineer’s engine has to run, but not an artist’s depiction.) But, in my view, what characterizes many artists is quite the opposite: they seem compelled to accomplish, simultaneously, impossibly many incongruous goals! (Minsky, 1990, p. 231)

These varying attitudes towards the artist are also evident in the experiences reported by some of the participants. As Wilson (2002) observes, “artists resist categorization” (p. 8). (However, Wilson lists categories in which traditional artists can engage with new technologies; see below and Chapter 2.) Catts describes Wilson’s Information Arts (2002) as “The Bible” for technologically based artists (O. Catts, personal communication, May 21, 2004). Wilson proposes that theoretical positions influence the way in which artists work with technology. He outlines
possible paths for artists who respond to new technology as follows: the "exploration of new possibilities" in which the art work acts as research; the "exploration of the cultural implications of a line of research" in which the art work "explores the narratives and conceptual frameworks that underlie the research"; the "use of the new unique capabilities to explore themes not directly related to the research; and the "incidental use of the technology" in which the research provides a resource for "intriguing or beautiful" images (2002, pp. 8-9).

In his review of the papers presented, and art exhibited, at the first Consciousness Reframed Conference, in 1997, Jones (1997) relate that, in connection with Seaman's work,

the real activity of an artwork for the contemporary audience is in the emergence of new ideas and new triggers for interpretation through the experience of the work. This has always been an aspect of the contemplation of an artwork, although historically the viewer's experience has been more passive. In VR [Virtual Reality] and cyberspace the artist may be able proactively to generate emergent ideas in viewers as they experience the immersion. (Jones, 1997)

Immersive interactive work requires the physical and mental input of the audience. However, perhaps Jones is not aware of the complex mental input that a deep engagement with some other works of art necessitates, and, in addition, the ephemeral nature of interactive work poses problems for viewers who wish to review their experience and re-access the work on later visits. Jones continues:

In the audience's contemplation of a painting, the durational element becomes little more than a slightly extended present, whereas involvement in VR, new-media or video work forces one to spend some time with the work simply to gain any idea or [sic] it at all.... Duration as a dimension or [sic] an artwork allows the producer or the work to introduce a series or ideas, or a flow and mutation of one idea, which is not available in most painting or sculpture. (Jones, 1997)

Ascott (2001) predicts that new digital technologies could facilitate a new consciousness of Becoming, whereby art, instead of being a "servant of expression" is now "more engaged in the process of creating reality, of constructing worlds, and in a sense legitimising all our own alternative realities. in this way [digitally based] art is an agency of Becoming ... a constructive, more than expressive or decorative,
process” (Ascott, 2001). Of art in general, Ascott intimates that it can work on social and political levels but, in particular, he claims that it is the indirect relationship between artist and viewer that “protects the artist and permits our dreams and visions to have currency and survive” (2001).

Ascott sees a role for new media in constructing new realities, but Wilson warns that “Critical theory wants to explode the concept of art and questions its continued usefulness” (2002, p. 17). He predicts that artists working in sci-art and technological research will push for the inclusion of their art work within the definition of art. The numerous journal articles, conference papers and texts sci-artists, such as Casts and Zurr, write about their practices lend credence to Wilson’s theory, and a desire to be regarded as ‘true’ artists may well be an additional motivation for their many publications. The idea that sci-artists wish to be regarded as ‘artists’, and their work as ‘art’, implies that they see value in such recognition, and it could be that they are attracted by the prospect of incorporating their practices within conventional art paradigms.

Castleden is adamant that artists have always had a role as critics or commentators on political, social and philosophical levels, and that their voices have been clearly heard. She says “it’s always been the role of the artist to stir things up a bit”, and suggests most artists are eager to explore new technologies and to discover new ways of working or being. Purves (2002) links “that artists are the scouts and the antennas [sic] of our society, and that they wish things to be a whole lot better and fairer, and more interesting and even challenging than they are”.

In addition, Castleden claims that “challenging perceptions of what art is, is absolutely a role of the artist”. In this regard, she explains that, for her, “what art is” means “in terms of engaging the viewer in elements of the artwork” not necessarily the form in which the art manifests itself: for example, “a block of wood on the floor, a painting on the wall, or an ethereal work on the internet”. Timms (2004b) argues for art that is more respectful towards, yet at the same time more demanding of, its audience, art that is neither facile nor wilfully abstract, rewarding patience, knowledge and dedication.... a means of asking serious and profound questions about who we are, where we have come from, and where we might be going. (p. 13)
Castleden notes that, although the role of the artist is to pose more questions than to supply answers, there needs to be a level at which the viewer can access the work. This access may be from several points of view: for example, an aesthetic aspect; a conceptual aspect; or from the aspect of a particular element in the work to which the viewer responds. To illustrate her point, Castleden refers to Rinaldo’s installation at BEAP, *Autopoiesis*, 2000.

Wonderful mechanical arms hung from the ceiling and followed the viewer around the room. Although they were highly technology based, the actual struts of the arms were made of grape vine canes and, even for the most unperceptive viewer, surely to walk in and see such hyper technology with such simple, natural elements, is automatically a critique on those form/function, natural/mechanical dialectics. (Castleden)

Catts and Zurr question the use of the generic term ‘artist’ in the research questions because, as sci-artists, they need to be innovative in the presentation of their work. In their view, the role of the artist is difficult to define, due to the many different forms of engagement and activities for people working in art. They proffer that, for them, it is important that artists deal with critical, social issues, and use disturbing images if necessary, but they concede that this is not necessarily the case for more formalist artists who derive their imagery from scientific developments.

Catts and Zurr find it difficult to understand why some artists feel threatened by new collaborative sci-art practices because, in their view, it does not mean that traditional technology is obsolete or irrelevant, but that sci-art represents another way of engagement in social debate and artistic practice. They emphasise that they do not “chase” new technologies, but engage with them because of the profound issues these technologies raise, and because these issues need to be debated and resolved.

Zurr perceives that “the role of the avant-garde artist, the critical artist, is to raise problems, and to question the status quo.” With regard to new technologies Zurr says:

It is still too early to know how things will develop and now is the time to open up the debate rather than to close it. That is what we are doing – we are creating evocative objects in order to open up debate. (Zurr)
Calts argues that knowledge should not be segregated, controlled, and explored by only one group of people; for example, scientists. He identifies a social responsibility for all members of our contemporary society to discuss biotechnological developments. He also points out that “it is frequently those areas that are considered to be a ‘no-go’ zone for artists that are already being exploited, not just by scientists for knowledge, but by profit driven companies for consumer goods.” The sale of genetically modified fish as pets, for example, is acceptable but, Calts says, “if the same fish were to be in a gallery, the outcry would be “You have to prevent artists from modifying living species”. (Calts)

His comments underline the conundrum between differences in the way in which technological and scientific advances are regarded in a scientific context, in a commercial context, and in an art context. Greene (2000) notes the need to understand issues in context, and the three situations outlined are characteristic of the possible tensions that present when science, art and commerce meet at the threshold of new technologies.

Calts’ observation on intention is mentioned in Chapter 5, but it is relevant in this context, too. He states that “since the days of Duchamp artists don’t really have to justify their practice. They only have to justify their intentions. So that opens up the whole realm of human activity to justify the art practice.” Horsfield (2000) suggests that contemporary society sees intention as irrelevant, and that it believes “things or events or facts cannot be understood, only recorded or described” (p. 107). The import of this for artists is that art critics and historians take upon themselves the role of interpreter. “My slight unease with the interpretation of historians or philosophers is that it cements, it embeds, more necessarily, their intervention. The audience are [sic] only going to get to the surface of the experience” (p. 108). Horsfield participated in three exhibitions where the intentions of the artists were subverted by the curators. He suggests that frequently an “a priori justification” is added, after the event, to art whether that work is by a student or an established artist.

It seems to me entirely invidious that we come to be through that intention. We should first look at intention. We shouldn’t attempt to teach it. We shouldn’t attempt to use it as a means for assessing value,
so that we can judge. We should first of all address why we make art, why we exist as political beings, how we move through the world; all of these seem to be absolutely the base. (Horsfield, 2000, p. 109)

For Clancy, the artist’s role varies according to circumstances but artists’ integrity to themselves and to their creative process is of prime importance. In this sense, Clancy encourages formulaic artists to challenge their process and to push their work to a higher level. She recommends that, as applies to all members of the community, celebrity artists, such as Tracey Emin, and unknown artists, all have a responsibility to avoid racist or disparaging statements.

Cleworth would like to believe in the notion of a contemporary avant-garde, not for its own sake, but to push boundaries, and to question new and pre-existing conditions whether they are economic, social, or cultural. Nevertheless, he queries whether contemporary artists can fulfil the role of “pushing boundaries” and instead are “anything other than producers of products and entertainers”. The performances of Stelarc, and audience interactive fully-immersive visual/aural virtual installations, such as Ephémère, by Char Davies, are two examples of work that could be experienced as entertainment. This raises the question whether or not artists take advantage of the ‘incredible passport’ to which Wallworth claims they have access (see Chapter 6).

To take advantage of artistic ‘passports’ requires funding, and Cleworth raises issues emanating from economic rationalism. These also concern Verwoert (undated), who contends that it is economic principles that provide the “master-plan or hidden agenda” for the “reconciliation of art and science”. He suggests that the promotion of interdisciplinary collaboration is in keeping with the “spirit of this new economy”, and encourages interaction between equals rather than “top-down hierarchies”. Verwoert notes that this economic agenda “remodels the artist as expert”.

This understanding of the artist as a professional is no doubt a progressive perspective; it implies the acknowledgement that artists are producing actual work and make a real contribution to society. It thus does away with the popular suspicion that artists are nothing but a bunch of dubious idlers. At the same time, however, the concept of the artist as professional leaves unquestioned the basic utilitarian assumption that art should be useful. (Verwoert, undated)
Cleworth wonders whether the economic and social conditions prevailing today are so powerful that they will subsume or contain any level of critical debate and critical "outsideness" in such a way that anyone truly "outside" will not have a voice. Nevertheless, he recalls that "many of the greatest artists have worked in accord with the state or the church and have still produced wonderful work with great insight". Therefore, he anticipates that it will only be in "a hundred years' time" that historians, like archaeologists, will be able to reflect on whether the artists of the early twenty-first century were not only reflecting on their culture, but also participating in debate and instigating change.

For Benjamin, it is important that he mixes with the wider community to gauge current concerns and "to be inspired by other things", a process he describes as "cross-pollination". Nevertheless, to develop a satisfying art practice, Benjamin understands the artist's role as "a constant series of breaking down doors within oneself rather than socially". In his work, he wants to share with his viewers a quiet moment of reflection, and, through that time of stillness, a feeling of empowerment. Qualities of transcendence and beauty, which he stipulates are not "decoration" or "shallow decadence", are important to Benjamin who adds that beauty is a difficult characteristic to achieve (see Chapter 4).

Benjamin's experience that "something else takes over with the finished piece" is in common with that reported by many artists. He explains that the artist stands at the easel and works, but cannot envisage what the finished work will be because, as the work proceeds, a creative element takes over and the work takes on a life of its own. This creative element Benjamin can only describe as magic. He believes that this magic resides in great pieces of art and that "it is undeniable, but also indescribable". Kneller (1965) empathises with Benjamin's experience.

At some stage in the process of creation the creative product - whether painting, poem, or scientific theory [italics added] - takes on a life of its own and transmits its own needs to its creator. It stands apart from him [sic] and summons material from his subconscious. The creator, then, must know when to cease directing his work and when to allow it to direct him. He must know, in short, when his work is likely to be wiser than he. (Kneller, 1965, p. 61)

Nevertheless, Kuhaupt decrees that the role of illustrator should be avoided. Bunt agrees, and doubts that the illustrative work that frequently results from
scientist and artist collaborations could be deemed art. Although he subscribes to the notion that “Artists make problems, and good, challenging art invents or creates tensions, so that things which are not necessarily there are created”, when asked to describe the role of the artist in society, Bunt hesitated to answer because he felt unqualified to respond. From his notes he proffered “to stimulate, to create, to propose, to enlighten, to please, even”.

Long agrees that art should be engaging, but also argues that it should be controversial. His view is that a contemporary artist “should be someone who presents ideas and concepts that engage, challenge, and evoke response in people and communities at large.” Long believes humans tend to develop a “certain mind-set”, and he would like to think that art can jolt people “out of that linear way of thinking and look at the world in a fresh way.”

According to Meikle, good art provokes thought or an emotional response. He suggests that artists could reflect to society the current thinking and philosophies of the day in order to provoke a reaction, and focus on, and try to express, some of the biological concepts and conundra that are still unexplained. Much of the sci-art of which he is aware uses well known biological concepts as a medium to express an idea, such as the structure of the body, how the body works, or the way cells divide. Instead, to earn legitimacy, Meikle proposes that artists “address some of the really difficult questions that cannot be understood at the moment, and try to find a way to visualise those concepts.” As Berger (1972) writes: “images were first made to conjure up the appearances of something that was absent” (p. 10). Meikle’s proposal is in accord with other participants and has implications for the section on prescient artists below.

McLachlan reiterates his preference for the term “men and women working in art or science” rather than artist or scientist, and is doubtful that he would wish to “give them a role”. He believes curiosity and having fun are the elements that assist artists and scientists to produce their best work, not necessarily an altruistic desire to help humanity. If, subsequently, the work can be demonstrated to have value, that is not necessarily part of the initial motivation. As McLachlan would have it, artists and scientists have the same responsibilities as other citizens and, along with other community members, they are able to exercise their own freedoms.
However, he avers that there is an ethical limitation on how far those freedoms can be deployed if they impact upon the freedom of others.

Further, McLachlan proposes that the views of scientists are always subordinate to those of society, and that scientists do not have the right to determine ethical conclusions on their own — they cannot say that something ought to be done, speaking as a scientist.

The termination of pregnancy, for instance, is something that I can provide information on but my view is equivalent to somebody else's view, and the way we have chosen to make decisions like that is through the democratic process. Therefore, I think artists and scientists are bound within this system. It is not perfect, but it is better than any alternative. (McLachlan)

Nicholls believes that the artist, as a function rather than as an individual person, has a role in what is called the "civilisation of society", or, a term she prefers, the "health of society", a "sustaining" society. She notes, for example, that the Aboriginal community had a sustaining society; they had art and culture. "Society needs to have art or the community becomes disaffected, more disjointed as an organism, so that if you take a city as an organism, the level of art in that city is an indication of its health" argues Nicholls. In Chapter 4, Nicholls points out that, according to Maslow’s Hierarchy of Needs, a society’s basic needs, such as food and shelter, need to be provided before attention can turn to activities such as art. Citing Melbourne as an example, Nicholls says that the city is “thriving at the moment” [2003], it is “a growing society and a healthier place, and I do not think that it is a coincidence that it can cope with the building of Federation Square [a project considered controversial when first mooted] now.” The city also has recently supported street sculptures, and a freeway entrance to the city which resembles a zipper — a massive piece of sculpture which Nicholls thinks is “partly an indication of art with function over form”.

Although Piccinini doesn’t delineate a specific role for the artist, her aim is to make work that is meaningful and with which people can engage.

Susan Norrie, an Australian artist with an international profile, sees her role as an artist as follows:
Technology too contains an eschatological dimension within its power, its force and its presumed qualitative successes. If we are indeed at such a critical and significant moment in our history (the possibility of the end of existence, and the eschatological effect relating to industrial accidents and terrorism, etc.) then, as an artist, it is important to take on the responsibility of investigating and documenting the truths and experiences of our time. (cited in Engberg, 2004, p. 567)

However, it is the sustainability of an art practice that concerns Bullock (2000). He contends that the biological metaphors used to describe artists' works and practices, such as to "flower", "mature", and "to be nurtured", are indicative of "the fragility and vulnerability of the artist within a culture where his or her success is dependent on external factors" (p. 29). He has experienced the necessity to work outside the studio to support him, and his art practice, during the long periods between exhibitions before his career was established. Bullock is also aware that, although the art world considers it essential for an artist to be innovative and "to progress ... in terms of concepts, technologies and materials", frequently the collectors who follow the artist's career are not as enthusiastic for change. In his experience, the wider public is "conservative and reserved in what it will collect" (p. 28). To develop sustainable practices, Bullock urges artists to use their skills and abilities to design strategies to adapt and to meet the challenges of a system where there is an "unfair emphasis on the artist's generosity" and other art world participants are allowed "to be too passive" (p. 29)

The artist as inquirer

Sontag (1967) does not support the concept of a conflict between the 'two cultures' but suggests "we are witnessing ... the creation of a new (potentially unitary) kind of sensibility.... Art today is a new kind of instrument, an instrument for modifying consciousness and organizing new modes of sensibility" (p. 296).

Catts and Zurr are typical of biotechnologically based artists who are working in the realms of consciousness and new modes of sensibility. However, artists working in sensitive areas need to be alert to the scrutiny their work could attract, as the following events in the United States of America indicate.

These events did not occur from lack of due diligence on the part of the artist. In the early hours of May 11, 2004, Kurtz, a biotechnologically based artist and
academic, telephoned the emergency number because his wife had suffered a cardiac arrest and died in her sleep. The police arrived and, suspicious of Kurtz's (legal) sci-art equipment, called the Federal Bureau of Investigation (FBI).

Within hours, FBI agents had detained Kurtz as a suspected bioterrorist and cordoned off the entire block around his house. Over the next few days, dozens of agents in hazmat suits sifted through Kurtz’s work, analysing it on-site and impounding computers, manuscripts, books, equipment, and even his wife’s body for further analysis. Meanwhile, the Buffalo Health Department condemned his house as a health risk. Though Kurtz has finally been able to return to his home and recover his wife’s body, the FBI has still not returned any of his equipment, computers or manuscripts, nor given any indication of when they will. (Kroker & Kroker, 2004)

Kurtz and two other members of the Critical Art Ensemble (CAE), which “produces artwork to educate the public about the politics of biotechnology”, were served subpoenas at the Massachusetts Museum of Contemporary Art (CAE Defense Fund, 2004). They originally faced bio-terrorism charges. In July, 2004, Kurtz and Ferrell were charged with four counts of mail and wire fraud, which each carry a maximum sentence of twenty years in prison. Their attorney claims that these charges are historically used when the government cannot prove other criminal charges.

Fund raising activities to assist with Kurtz’s and Ferrell’s defence have been held internationally, including in Perth, Western Australia. In a plea for funds to assist with legal costs, CAE’s peers state:

The equipment seized by the FBI consisted mainly of CAE’s most recent project, a mobile DNA extraction laboratory to test store-bought food for possible contamination by genetically modified grains and organisms; such equipment can be found in any university’s basic biology lab and even in many high schools. (CAE Defense Fund, 2004)

Claiming work is non-scientific is another strategy to undermine the credibility of the artist as researcher who questions scientific assurances. An example is the invocation of the theory of the emotional artist in conflict with the intellectual scientist. One person to receive this attention is Cornelia Hess-Honegger, who graduated from the Zoological Institute of the University of Zurich, qualified as a scientific illustrator at the Zoological Station in Naples, and then worked at the
University of Zurich. Later, alerted by her observations in her garden, Hesse-Honegger became concerned by scientific assurance, made available to the public despite the lack of biological research, that low level radiation from Chernobyl would not damage insect or plant life. She uses her professional experience to document in word and aquarelle paintings the "morphologically-misshapen specimens" she discovers in her field research, and to "raise complex issues about the role of the artist in objectively charting the often invisible decline of the environment" (Ruskin School of Drawing and Fine Art, 1996). Hesse-Honegger's research has extended to the environs of the nuclear plants at Sellafield, UK, Three Mile Island, USA, and the Kruimmel nuclear power plant in Germany. Evidently the HAARP Project in Alaska now looms on her radar.

According to Hesse-Honegger, "We don't consider artwork to be a form of research, neither [sic] the artist as a seismograph on our time", but this is changing. She is also dissatisfied that the use of "copied pictures and virtual realities" in education is replacing skills such as painting which teach perception and the ability "to see what is" (Hesse-Honegger, Undated). Kemp (1998) agrees that these "acts of seeing", and their interpretation in the "hand-drawn image", continue to have a role in the illustration of scientific entities. However, he qualifies this endorsement by asking if Hesse-Honegger's work, despite her academic background, constitutes "evidence", and, indeed, whether they are "works of art or scientific illustrations?" Nevertheless he "sustain[s] the right of the obsessive enquirer to probe uncomfortably into visual corners where dark questions lurk" (Kemp, 1998, p. 555). His enquirer role parallels that of Meikle and McLachlan who propose that the artist looks for the minutiae that possibly lurk in-between the 'known'.

The problems faced by Kurtz and other members of the CAE challenge Edmondston's notion that artists are regarded as having wider freedom in the community. Hesse-Honegger deduces, from the scientific community's "loud and aggressive" objections to her work, which she surmises could emanate from the fear of withdrawal of research funding if scientists support her findings, that artists "are almost the only independent voices in our society" when their art practices are not dependant upon funding that is tied to an agenda (Undated).

Nevertheless, my local chemist reminds me that there is a very large art audience that considers the role of artists is not to question, but to represent nature
(personal communication, November 28, 2004). His view is reflected in the growing number of monthly instructional magazines for recreational artists available in Australia.

Inaccessible didactic panels and art

The use of difficult language to accompany art exhibitions applies to traditional as well as biologically based work. The promotional material for Su Baker’s *Mis-en-scene*, 2004, exhibited at Curtin University of Technology, reads, in part:

Su Baker has produced a significant body of new work in *Mis-en-scene* to explore a new aesthetic of painting in a post-cinematic, post-art, post-critical age. As Baker says herself this is an impossible but aesthetic ambition. The new work can be seen as ciphers of subjectivities, residual deposits of, in this case, pictorial stylistic playthings. This is not a return to an anti-intellectual essentialism or reductive formalism, or to the abandonment of narratives, nor does it propose a single orthodoxy — but, on the contrary, it proposes to embrace a free-form complexity, multiple genres and eclectic reference points, it aims to invest in the silent, visual and libidinal economy of painting with a sense of intellectual gravitas, to empower the scopophilic enjoyment of making and looking with an underlying seriousness — indeed, a serious pleasure. The “serious pleasure” of making and looking and what could be more serious than that. (John Curtin Gallery, 2004)

Nelson (2004) reports that the work in 2004: Australian Culture Now, exhibited in Melbourne, at ACMI and the National Gallery of Victoria (NGV), was overshadowed by the number of essays accompanying the exhibition. On the other hand, Crawford (2004) found “welcome relief” that “the diatribe that surrounds contemporary art” is absent from the presentation of John Wolseley’s work in 2004: Australian Culture Now. Wolfgang Laib contends that the less the artist says, the more the art is open to engagement with the audience (W. Laib, personal communication, February 15, 2005).

Edmondston was hesitant, at first, to respond to questions concerning the curatorial problems with science based art due to lack of personal involvement. However, as a viewer and from a science perspective, she recommends that helpful information makes the art “more useful”. She proposes that curators also need information and background about the work, “and the justification of it as an
art/science collaboration." Edmondston and her prospective collaborators intend to provide scientific information, complemented by additional events and material, including seminars, focus groups, postcards and questionnaires, to increase awareness and understanding of their project's subject matter. The responses will be evaluated to gauge the effectiveness of the installation as a science communication method. According to Edmondston, Baroness Susan Greenfield portrays science communication as either technophilic or technophobic, but Edmondston intends that their installation project will aim for neutrality in that it will not try to persuade or influence the audience in any way.

Bunt contends that the work created by the more traditional artists during and after their residencies at SymbioticA does not require words to explain the artists' intentions. In contrast, discussion about the necessity for didactic panels to accompany scientifically based work, such as Worry Dolls, arose during their exhibition at the Perth Institute of Contemporary Art (PICA) in 2002. Bunt recalls that scientists asked how members of the public could understand what was happening in the large, black dome structure without explanations about tissue culture. However, he observes that members of the public did not complain and appeared comfortable experiencing the work in their own way.

ConVerge, 2002, featured bio-art including that of Piccinini and Cats and Zurr. [The presence of Piccinini's work in ConVerge suggests that it is regarded as bio-art, but she reports that she was hesitant at first to be a participant in this research as she believes her work is not biotechnologically based.] Radok (2012) felt that the Pigs Wings installation by Cats and Zurr at ConVerge needed more audience information and left the viewer "dumbed down" (p. 11).

The foregoing examples indicate that it is difficult to negotiate between too much and too little information. They also foreshadow questions about the raison d'être of sci-art. Is sci-art a form of entertainment? Is sci-art an educational tool? Is sci-art intended to interrogate and challenge biotechnological developments? Is sci-art art?

The need, or otherwise, for veracity in statements provided to accompany art work at exhibitions arose during the interviews. Bunt is tolerant of artists who give incorrect information regarding scientific aspects of their sci-art projects, and bases his opinion on the premise that the art work is not going to affect the direction of
science. Drawing on MEART (described in Chapter 3) as an example, Bunt acknowledges that most viewers do not fully understand what is happening in the installation, but, for him, the important point is that it stimulates thought about the whole issue of creativity, and it proposes a 'contestable future'. "Are robots, cyborgs, in the future, going to be creative? What do we think about combining living organisms with machinery?" Bunt acknowledges that, prior to installing MEART, the artists and scientists involved discussed whether it was necessary to establish the connection to Atlanta, or whether it would suffice to have a screen with images which purportedly came from Atlanta. Although, in their view, the latter would have had the same impact, the team members decided that they would "do it for real" in deference to artistic integrity. Jones (2002) contends that, although MEART relates to issues surrounding artificial intelligence and cyborgs, "endlessly, tediously drawn lines from the robot arm plotter pens make for something like abstract expressionism done by an obsessive compulsive Jackson Pollock". Colless (2003) draws attention to the ethical and aesthetic issues latent in this "semi-living artist" installation [MEART] (p. R19).

Bunt suggests that another consideration for the scientists and artists involved with sci-art is that critics have suggested that the work could prompt false hopes or false impressions; for example, that sentient cyborgs or the possibility of growing "wings for people" will be available in the foreseeable future. On the other hand, Bunt claims that if the work is explained in great detail, it may remove the impact:

If you explained in great detail that MEART is really using nerve cells as a random noise generator, which is what I think it is doing, and you have a totally arbitrary computer programme that picks up bits of that noise and decides it will paint in red or green or blue, that diminishes the work not improves it, even though it is truthful... If you totally demystify the work, that can actually be negative, because remember these are not teaching pieces, they are not there to be a science museum. If you want to teach the public about tissue culture and cyborgs, that is for the science museums, that is where you do that, or in a lecture. Not in an art gallery. In an art gallery if the work is ambiguous, or even misleading, that is not important. (Bunt)

To demonstrate his point, Bunt explained that some members of the public, including a few who had knowledge of scientific fields other than neurobiology, assumed that the nerve cells were really controlling the arm, and that there could be a
small brain there that was actually registering "things" and responding. He understands that it is possible for a public attuned to science fiction films, such as the Terminator series, to assume that such complex scientific developments are possible. Bunt suggests that the idea of such misconceptions is justified by the sight of members of the public crying at the end of the "dying" ceremony when the Worry Dolls are exposed to human contact: "the people have imbued the 'blobs' of cells with sentience and life which is not the case". However, one could then question whether the TC&A members are encouraging this perception by labelling their creations 'semi-living sculptures'. Bunt maintains that a big difficulty for science is that the results of many discoveries are counter-intuitive and such discoveries are frequently regarded with scepticism.

For Clancy, the field of bio-art and new media is still new and needs time to evolve. Artists who work with biotechnology and living organisms need to explain more about their work and are developing a new language system, whereas artists who work with traditional media, and media such as video, "can possibly engage to a greater extent with more people because it is more of a known language". Asked whether the information that accompanies the art work needs to be accurate, Clancy replies that

with the work of Catts and Zurr, the information needs to be accurate in the sense that what they are showing is semi-living. It needs to be alive. In terms of, say, my bacteria drawings, people want to know how they are done and what it is, so I think there is more of an explanation of that needed. When I was showing someone the abstract of my paper for the aaANZ conference [2003], and it said Andre Brodyk is the first Australian artist who has exhibited living genetically modified organisms, they said "Didn't Stelarc do that?" I said, "No, because his wasn't genetically modified". (Clancy)

Clancy agrees that Stelarc's work was 'living', but is concerned because the person who queried her abstract "would have known exactly what genetically modified foods were". She cites another example of areas where confusion can arise:

I showed a chromosome video made as part of the Body Manufacture project. The video was derived from my karyotype; I animated the chromosomes. I thought it wouldn't stand on its own as a piece because it was part of the overall installation.
but someone said to me that it just becomes abstract, because people don’t know exactly what they are, and how is the audience supposed to see that it is real chromosomes. It was really important because it is a form of self-portraiture and I needed to explain that the work developed from my chromosomes. (Clancy)

Clancy explains that it was important to her that she had the experience of imaging her own chromosomes as the process was symbolic, particularly as the work was a self-portrait.

Edmondston believes that it is difficult to prescribe what information, if any, needs to accompany sci-art installations. Some work is difficult for the public to interpret without supporting information. Other work “comes laden with its own message, like Patricia Piccinini’s, which obviously has that definite ‘yuck’ factor. They’re cute, but my experience with it is that you show people things and they think ‘oh that’s revolting, are they really going to create these sorts of things?’” [Piccinini states that she does not collaborate with scientists and does not claim a scientific basis for her creations. Her interview was conducted after my interview with Edmondston and, of course, Edmondston’s comments were not reported to Piccinini.]

Although the public might find sci-art installations visually interesting, and stimulate debate about genetic engineering and other developments, Edmondston doubts whether such work informs them about the science unless it is supported by accessible information. Whether sci-art installations are “useful” depends:

on the art work and the intentions of the artist, because I think a lot of them are quite sensationalist and shocking, and I think that’s fine. It gets people thinking about it, but if there is nothing to direct that thinking, do you just reinforce preconceived ideas about where it is going, or do you increase the shock value of it? (Edmondston)

Australian artist, Judy Watson, frequently exhibits internationally, and understands that the research she is able to present with her work in Australia is often not available to subsequent viewers nationally and internationally. She states: “In the end, as an artist you have to realise that your work has to impart a sense of itself without all that background information, so it has to work on its own terms” (cited in Mackenzie, 2004b).
A similar situation pertains with Castleden's work. She leaves the viewer to interpret her art at whichever level they feel appropriate. Blend (2004b) reviewed her latest exhibition, Souvenir, and applauds her approach: "Her wise avoidance of tying her work to a specific didactic meaning widens its possibilities" (p. 13).

Further, Castleden deplores the tendency towards a high-brow, elitist attitude that "distances the knowing from the unknowing, or the initiated from the uninitiated". She cites Narelle Jubelin's exhibition On Writing: Writing On, 2002, at the John Curtin Gallery as an example of work that was supported by a wide volume of knowledge and theory, but that permitted many "ins" for people who were not familiar with the complex background to the artist's work. Castleden contends that there is a fine balance between accessibility, non-accessibility, and over-explanation; the latter being a frequent criticism of political art. To summarise, Castleden thinks the role of the artist is to push boundaries, to critique contemporary society, and to embrace the new where relevant. She is a believer in the "wow" factor in art that engages and encourages a receptive audience, upon which Robert Irwin elaborates as

The best moments in our [art] lives are, you're going along, and all of a sudden it's Wow! And then you wander around for a while saying, What was that? You know, you're changed. To me, that moment is the moment when art can exist. (cited in Sobchack, 1993, p. 74)

Although Catts claims that artists only have to justify their intentions, not their art practice, he recognises that there are issues that arise when one endeavours to contextualise art, such as biologically based work, within an historical framework. He places the responsibility for this in the hands of art historians. Artists with sci-art practices are not really disturbed by the fact that their work does not fit within a current curatorial and art historical framework, according to Catts. He suggests that the problem concerns art historians, critics and other artists more because they are not sure how to deal with the work, but admits that one relevant criticism of the new media art scene is based on the lack of tools to evaluate whether it is good or bad art. Catts ponders that it is probably just a matter of time to allow the development of an historical framework, but that, even if it is bad art, if it creates discussion it is worthwhile doing.

In recent years, assertions have appeared in magazines and newspaper articles that contemporary art is elitist, that the 'person in the street' finds it
incomprehensible, and that many of the didactic panels are unnecessarily complex. Timms (2004b) suggests that material that is difficult to understand does not represent a genuine "attempt at communication", and could be interpreted as patronising and discriminatory. He argues that a resort to "mindless self-promotion" and "arcane theoretical discourse ... surely indicate deep-seated anxieties about the present predicament of the visual arts" (p. 11).

In addition, Timms hypothesises that the preponderance of explanations accompanying art work encourages the audience to rely on that information rather than to explore the ideas expressed in the work themselves. He encourages artists to consider the obligation "to invest their work with conceptual complexity" unnecessary. Timms also suggests that an over reliance on explanatory panels leads to the "trivialisation" of art and that, "paradoxically, the more sophisticated and intelligent the commentary, the greater its trivialising effect may be" (2004b, p. 111).

"Poorly communicated, unintelligible mind-sludge" is Reid's description for the "fine art visual philosophy" that frequently accompanies contemporary art (Reid, 2002c, p. 36).

The significance of materials or expression medium

"Unlike God, the artist does not create matter; he [sic] works with it" (R. Berger, 1963, p. 43).

As noted earlier, Bunt observes that stem cells provide artists with a new material with which to work. The availability of these new technologies and materials is a pivotal issue in the development of sci-art collaborations, and, although the dialectical processes of this development have been commenced upon in Chapter 8, it is worth acknowledging here the substantial shift in art practice that access to laboratories and scientific material has precipitated. In particular, the characteristics, often intangible, of the materials artists use typically have an influence on the outcome of their work. The research participants did not mention the properties associated with the stem cells, or bacteria, or other 'semi-living' matter, used in the sci-art process. Nevertheless, work that concentrates on the illustration of science, and art in which the medium dominates, are circumstances that concern many participants as their comments throughout this thesis signify.
These two situations, illustration and medium domination, both, in part, result from a lack of consideration of the “expression medium”, as Hofmann describes it (cited in Chipp, 1968, p. 538-542). In new media, similar situations occur when artists are more concerned with the medium, and its ‘banner’, than with the content, as discussed by Whitclaw (see Chapter 2). Benjamin and other participants in this study. In such instances, the medium is not used as the means of expressing an idea, but as the subject matter, or idea, itself. Berger (1963) asserts:

One can no more appreciate a work of art without regard for its material than one can speak a foreign language without regard for pronunciation, articulation, and so on; for awareness of material is what makes our response an experience, and not merely an idea. (R. Berger, 1963)

Hans Hofmann (1880-1966) established art schools, first in Germany, and, in 1932, in New York. His philosophy on art still has currency in art schools today, and an important tenet of that philosophy is the part played by the “expression medium”. Artists need to understand and sense the qualities inherent in the medium of expression to enable their ideas to be satisfactorily conveyed, according to Hofmann, who adds that “the idea is transformed, adapted to, and carried by the inner quality of the medium, not by its external aspect” (cited in Chipp, 1968, p. 541). It is in response to this quality of the individual expressive mediums that Hofmann maintains different mediums can convey the same formative idea.

Instances of scientifically insightful artists

As mentioned in Chapter 4, Long suggests that art is required “to create something new in order to present something that has not been seen before.” Leonardo da Vinci is usually the first person discussed when examples are sought of artists who have envisaged scientific phenomena. Because my research covers contemporary artists, I am limiting the few historical examples mentioned to some of the more well-known instances in the twentieth century.

“Revolutionary art and visionary physics” differ in methods but both aim to investigate “the nature of reality”, asserts Shlain (1991, p. 16). He suggests that the artist’s images can pave the way to change perceptions of the world. “Repeatedly throughout history, the artist introduces symbols and icons that in retrospect prove to
have been an avant-garde for the thought patterns of a scientific age not yet born" (p. 19). Shlain also points out that Marshall McLuhan, in Understanding Media, "dismisses the importance of art" (1991, p. 19).

Miller (1995) claims that "Constable and Seurat embody the effect of science on art." But, Miller says, in the twentieth century, Socrates (see epigraph this chapter) is supported by artists such as Cézanne and Picasso who "began in-depth explorations of a world beyond visual appearances, of the world as the artists saw it to be" (p. 186). Further, Root-Bernstein suggests that the artists who "invented anamorphic painting, fauvism and pointillism" pioneered the "scientific use of artistic techniques such as anamorphic distortion, false coloring and pixelization" (2004, p. 93).

František Kupka immediately springs to mind as a prescient artist. A polymath, he is hailed as the first painter to show totally abstract work in the Salon D'Automne, 1912. Andel (1997) reports that Kupka educated himself in contemporary scientific research, including frequent visits to the planetarium in Paris, and maintained that, although "art represents a different means of cognition from science", artists can learn from, and be inspired by, science. Kupka informed himself about many areas of science, attended physiology lectures at the Sorbonne, and worked in the biology laboratory there (p. 88). The following incident, which Kupka described in a letter in 1897, supports the theory that inspiration follows information.

"Yesterday I experienced a state of split consciousness in which I had the impression of viewing the Earth from outside. I was in a large empty space and could see the planets silently turning." The vision was the inspiration for the painting The First Step, 1909-1913 in which the crater shaped motif also appears and on which The Cosmic Spring obviously draws. (cited in Andel, 1997, p. 87)

An exhibition held in Switzerland, in 1958, celebrated the bicentenary of J.R. Geigy S.A. Jaggi (1960) records that the theme of the exhibition was the coincidence of scientists "revealing to us new and unexpected beauties of form in nature" while artists were creating abstract images of similar elements of form. He observes that conscious influence was not a factor but that the basis for this meeting of practices stemmed from the "intellectual climate" of that time (p. 8). Artists whose work was exhibited alongside scientific images with similar characteristics included Cézanne,

More recently, Kemp (2000) quotes instances of contemporary artists whose work has been likened to technological developments in science of which the artist has had no knowledge. This situation is to be expected, writes Kemp, as artists “have always created images framed by the leading paradigms of their society” (2000, p. 7). Cleworth suggests that artists need to be intuitive and receptive to new developments, or pointers to new developments, but says that they are not necessarily ahead of their times.

Root-Bernstein (2003) supports the significance of the polymath artist and scientist. He explains that the results of an artist’s fantasy or imagination, or innovative thinking, might possibly “turn out to be what actually is. Unexpectedly, a painting can sometimes be a way to generate scientific ideas” (p. 268). Drawing skills, as well as other skills in the humanities, are advantageous for a scientist, he adds. “Being cultured is still a prerequisite to being educated, and education is still a requirement for being successful” (p. 270). Root-Bernstein provides many examples of scientists whose own art, or the novel structures of other artists, has inspired a leap in understanding that has facilitated a new scientific hypothesis. “The thesis that the arts may provide insights beyond the methodological capabilities of the sciences comes from the fact that the artistic innovations often precede and make possible subsequent scientific ones. Examples are legion” (Root-Bernstein, 2003, p. 273). He cites the following examples, among others: Anthcil and Lamarr, frequency hopping; Bakken, miniaturised regulators for electric output that contributed to the development of implantable pacemakers; Escher and Penrose, aperiodic tilings; Buckminster Fuller, geodesic dome structures, similar structures were later found in compounds and molecules (‘buckminsterfullerenes’ or ‘buckyballs’); and Walker, kaleidocycles (p. 274). Root-Bernstein’s statement that “since artists are trained to observe what other people overlook, they sometimes think about what other people never see” (2003, p. 275), accords with the views of Mckle, McLachlan, Clancy and other participants.

Another example is Diogo Queiros-Conde (2004), a physicist, who is collaborating with Danielle Grekoff, a painter, to explore his “belief that art has the
power to change imagination and thus to allow the emergence of new scientific
ide...” (p. 228).

Do artists contribute to the debate about biotechnological developments?

"The artist is the person who invents the means to bridge between biological
inheritance and the environments created by technological innovation" (McLuhan,

Catts and Zurr are clear that their use of tissue culture is intended to
encourage debate. Lowe (2002) was particularly surprised by the different
perspective on scientific developments Pigs Wings presented at the conVerge
exhibition, and the accompanying statement that “This absurd work presents some
serious ethical questions regarding a near future where semi-living objects exist and
animal organs will be transplanted into humans” (p. 53). The creators of Pigs Wings
would, no doubt, take comfort in Wilson’s (2002) assertion that those who work at
the cutting edge of science and technology believe that their innovations will lead to
“universal truths”. “As evidence of science’s validity, they point to the
accomplishments of the scientific worldview in building robust, cross-substantiating
theoretical structures, and in predicting and controlling the material and organic
world [italics added]” (Wilson, 2002, p. 13).

Clancy believes that artists contribute meaningfully to sci-art collaborations
and debate, but that the extent of that contribution is difficult to quantify. However,
Edmondston is not sure that sci-art always engages meaningfully and critically in the
debates concerning biotechnological developments, and thinks that the role of
science in science and art collaborations needs to be defined. She believes that
science and art are different disciplines in many ways: “science is by nature
almost conservative in its outputs ... it works in very small increments,
whereas I see art as progressing a little bit faster than that, and it has the
ability to do that.”

Specifically, Edmondston thinks that the science side of some of the sci-art of
which she is aware is “a little bit ‘soft’ in some ways”. She also uses Edurne Kac
as an example. Kac “started off with a transgenic green fluorescent bacterium
and made his way up to the rabbits”. In Edmondston’s opinion this is “useful art
work" because it appeals to a great many people who are "absolutely fascinated by this idea that you can take a fluorescent gene from a jelly fish, put it into a rabbit, and get a fluorescent rabbit." Further, Edmondston accepts "the rationale for putting this in a museum, or in an art exhibition, is that it will help people understand a little more the process behind transgenesis and creating, or genetically engineering, transgenic animals". However, she suggests that the creation of a fluorescent rabbit is entertainment, "a useful party trick", and not science. Edmondston states that, although the basic process can be used for a whole lot of different outcomes, it is not cutting edge. Edmondston's reference to Kac's *Alba* as a 'party trick', highlights some of the ways in which the subjects of sci-art are viewed, and the moral and ethical dimensions surrounding some practices.

Edmondston predicts that the technology behind tissue culture on scaffolds work, similar to the ¾ scale ear project of Catts, Zurr and Stelarc discussed in Chapter 5, will have very limited application.

> I think that it is going to be very difficult to generate three dimensional tissue culture creations that can be used to transplant into individuals because of the problems with blood supply to dimensions of tissues. It might be used for an ear, but my guess would be that a prosthetic ear is going to be a lot easier to generate in other ways, and probably more economically, than using this tissue culture ear. (Edmondston).

Edmondston then discusses Piccinini's *We are Family*, and admits that she does not know whether or not it is an art/science collaboration. Her observations support Timms' view that artists can help the viewer interpret scientific information but they are usually not in a position to establish scientific facts (Timms, 2004a, p. R19).

> The hybrid meerkats and piglets do create a platform for discussing transgenosis and the splicing of genes, but the whole idea that we are going to create these hybrid species I don't think is all that accurate, so the science behind that is questionable. (Edmondston)

According to Catts, the escalation of publicity about sci-art has led to some artists being represented as having an intimate knowledge of science when this is not the case. For example, Catts claims Piccinini was represented in this way at the
Venice Biennale, although Piccinini does not claim an intimate knowledge of science, and has previously indicated that her work is the result of her imagination and fantasies in response to the new technologies. He claims that recent promotional material now suggests that Australia is a "smart" nation and its artists are educated in science. Catls believes that it is really important for artists to engage critically with the new technologies, but to avoid misrepresentation. In his view, if artists who are commenting about technology represent themselves, or are represented by others, as experts in the field of science or new technology, which is frequently not the case, the integrity of the whole area of sci-art could be in question and the misrepresentations "might come back to haunt them."

Kuhaupt is familiar with the work of Catls and Zurr and, although it is not "arty" in his view, he applauds the manner in which they present and promote it. However, he questions the level of critique that qualifies sci-art as art, and notes that, in most cases, artists can only examine the science from arm's length.

Long argues that art should be engaging and controversial, and cites the work of Piccinini as a good example of art that does not "say anything bad" about genetic engineering but evokes responses from the community. He subscribes to the view that: "What science does is not good, or bad, or evil, it is just research." Long asserts that research brings new information, but it is the manner in which this information is interpreted and put into a social context that can make it appear frightening or technically bad.

It is the social context in which Piccinini's work is received that concerns Cregan and Scanlon (2004). They claim that the discussion the artist aims to promote "is curiously slanted" and, "when it doesn't descend into fantasy representation" it is based around "personal responses to biotechnology and its implications. Larger questions about biotechnology and what it means to be human are studiously avoided." (p. 40).

McKle believes that "the general public is sceptical about some of the recent developments, mostly those that present a moral dilemma." However, he would prefer to think that artist and scientist collaborations are "less concerned about those sorts of public perceptions and that their real motivation is exploring new ways to express their art, rather than worrying about what the
moral dilemmas are." On reflection, he comments that "some moral dilemmas, such as that presented by stem cell technology, are probably the areas that artists should or do migrate towards because they have the potential to provoke thought, which is partly what artists are attempting to do." But Meikle proposes that collaborations between artists and scientists could be quite successful in explaining some of the more difficult concepts, because scientists "do not communicate well" and have difficulty in "explaining their research in language that is understood by the general public".

McLachlan contends that collaborative scientists and artists do engage meaningfully and critically in the debates, but that there is a lack of public debate. In addition, he claims that the Wellcome Consortium documents are "disappointing" in this area, and art critics have, as yet, failed to initiate an informed discussion of the work. Following his sci-art project, McLachlan claims to be transformed into "a different kind of person" and feels inspired to "proselytise on behalf of this idea". Due to his experience with the Journal of Theoretical Biology and the events that followed, McLachlan's hypothesis is that once he mentions the paper in JTB, the follow up in Nature, and the £337,000 grant he received, he will have the immediate attention of scientists, and will then be in a position to indicate that, although relevant, these factors are not the most important point. He would then have the opportunity to go on to explain why scientist and artist collaborations are useful, and to work towards bringing about cultural shifts.

Nicholls characterises the Worry Dolls as "interesting, bizarre, and very challenging" but finds it difficult to quantify the influence of that, and similar sci-art work, on the wider global debate. Despite her fascination with biology, one work Nicholls heard about in London but declined to view, and which she classifies as "challenging" but "repulsive", involves the representation of a mortuary with dissected real human bodies. In Nicholls' opinion, the meaningful and critical input of art and other exhibits, such as Enlin's Tent, are questionable. She proposes that art works best when the audience is encouraged to feel rather than to be confronted by repugnant attitudes. For example, Richard Serra's Snake, 1997, which Nicholls saw at the Guggenheim, Bilbao, with "colossal steel plates that weave around and go up and out at different angles" invoked in Nicholls "a feeling of intimacy and mystery."
For Castleden, artists who engage with high technology, such as stem cell research, are not necessarily in agreement with the philosophy or motivation behind the research, but their engagement enables them to critique the technology from an informed position.

Benjamin watches recent stem cell research in wonder and is concerned that the speed of technological developments obviates opportunities for community debate on the ethics of their implementation. The few examples of biologically based art he has seen have failed to expand his knowledge of the research, or challenge his current thinking.

Mitchell (2002) expresses concerns as we move from Benjamin's age of mechanical reproduction to the age of biocybernetic reproduction. As Mitchell would have it, there is a "dialectical tension" in the term biocybernetic, and, rather than call the current era "the digital age" or similar, he proposes that it is an age of conflict between "models of calculation and control" and "new forms of incalculability and uncontrollability, from computer viruses to terrorism" (Mitchell, 2002, pp. 10-11)

Artists, technicians, and scientists have always been united in the imitation of life, the production of images and mechanisms that have, as we say, "lives of their own". Perhaps this moment of stillness in history, when we feel caught between the utopian fantasies of biocybernetics and the dystopian realities of biopolitics, between the rhetoric of the post-human and the real urgency of universal human rights, is a moment given to us for rethinking just what our lives, and our arts, are for. (Mitchell, 2002)

Mitchell's words were written after the United States of America went to war in Afghanistan and before the second invasion of Iraq, an event that could be seen as marking the end of his "moment of stillness". However, his words are also in sympathy with the notion that this is a period at the threshold of change, as signalled by Clancy, and as indicated by the diverse factors influencing the practices of contemporary conventional artists and sci-artists outlined in this thesis. Mitchell has pinpointed issues of concern that he believes warrant urgent debate, and many artists are in a position to engage in such a debate as they work towards new levels of expression and ideas.
Discards' into 'gold dust'

The concept that inspiration can be found in the discarded intellectual or physical matter of others is not new, and some participants provide excellent examples of the way in which these 'discards' can benefit scientists and artists. Berlin's (1979) notion coincides with their suggestion that there is a role for the artist to explore the 'in-between', the discards left mouldering between the great ideas of science and philosophy. He suggests that there are empirical questions, and there are the questions mathematicians or logicians ask, but between these two great classes of questions there are other questions which cannot be answered in either fashion. There are many such questions, and they include philosophical questions. One of the prima facie hallmarks of a philosophical question seems to me to be this: that you do not know where to look for the answer. (Magee & Berlin, 1979, p. 24)

That 'junk' sequences in DNA now appear to have "value as a reservoir of flexible potential for future evolution" (Levy, 2001, p. 172) typifies, to me, instances where matter or ideas that fall within, or create, "in-between spaces", as Levy (p. 173) describes them, can provide valuable input for art work. These 'discards' are regarded as areas of research potential by both scientists and artists. Asked why Beuys was a "giant" in the twentieth century art world, Rosenthal replied "it's to do with the expansion of a possibility, of looking where nobody has looked before - as Picasso did (cited in Jenkins, 1991, p. 76).

Wilson (2002) focuses on new media, but he concedes that artists and scientists are likely to be more observant of elements in nature than other people, and agrees that his 'artist as researcher' might very well value research according to criteria quite different from those of the commercial and scientific worlds. They might see aspects of the problems missed by the other researchers. The arts could become a place where abandoned, discredited, and unorthodox inquiries could be pursued. (p. 37)

McLachlan's connection with Storey could be seen as unorthodox but it was highly successful. He thinks that "creative scientists and creative artists have lots of similarities in approach in discarding things, and also in looking through the pile of discarded ideas from others." This element was brought
home to McLachlan during his collaboration with Storey, and "became a standing joke, in fact, because the metaphor was literal." Storey had created a series of "material dresses" from discards, "the cuttings and the things thrown away by others". Her next step was to make wearable clothing out of rubbish bags which was a "conscious joke reference". McLachlan, too, looks at ideas that have been neglected.

Often ideas don't fit into the current extant picture of the scientific area and, therefore, they are ignored. Therefore, at any one time in science, any area will have a perfectly convincing account. Text books do not say, for instance, such and such is unknown or not well understood. Everything is always presented as if it is convincing and finished, and somewhere within that there are little bits that you are not being told. These little bits that you are not being told are the bits that you cannot reconcile with the picture, and then somebody will pick up one of those discarded pieces and shatter the whole picture with it. (McLachlan)

McLachlan associates Einstein's Nobel Prize, which, he explains, related to "the photo-electric effect" and not the theory of relativity, with "one of these discarded pieces" that others had overlooked. Einstein's photo-electric effect "destroyed the whole of classical wave theory and the texts about physics for the previous one hundred years." In relation to Kuhn's notion of the paradigm shift, McLachlan claims that scientists and artists want to be a "paradigm shifter" and, to do this, they are "constantly scanning the horizon for the thing which will be the breakthrough, the thing that will be new and different". Kuhn (1970) cites situations in which a problem that "ought to be solved by known rules and procedures" but resists the best efforts of experts in the field, or the breakdown of a piece of equipment, lead to an anomaly that provokes new investigations. The results of these investigations can sometimes establish "a new basis for the practice of science", a "paradigm shift" (pp. 5-6). In my view, Kuhn's model of paradigm shifts, and his 'revolutions', correlate with a dialectical process in that they generate new schools of thought from which further investigative processes emerge, as referred to in Chapter 2.

The distinction between having problem seeking skills and having lots of curiosity is difficult to define, and McLachlan sees "looking for a problem" more as thinking "I wonder how that works". As an example, Galison (2002) describes the
image general relativity presents of an object falling into a black hole, and the manner in which the object moves through “redness” until its eventual move “beyond the visible”.

That scene resembles ours. Just when the scientific image moves towards abstraction we are left with the last glimpse of a frozen picture and ignore what happens next. At just that moment when the abstract-logical becomes pictorial, we forget the picture to celebrate that last remembered moment of non-image. It is all too easy to forget the incessant traffic back and forth between the scientific-artistic desire to grasp with eyes open and shut. (Galison, 2002, p. 323)

McIlte and McLachlan promote the notion that it is a legitimate exercise for the artist to interrogate, or "play", or "laterally investigate", the discards of science that represent the fragments of knowledge or inquiry which, through lack of interest, research outcome, or immediate financial marketability, lapse from scrutiny. Creativity, imagination, and resourcefulness would be traits necessary for a scientist or artist involved in such a pursuit to enable them to find, or even note the absence of, the missing links or discards. As McLachlan expresses it, “creative scientists and creative artists, I think, have lots of similarities in their approach to discarded things and also in looking through the pile of discarded ideas from others.” Kuhaupt has similar ideas and states that artists tend to look around for “things that don’t quite add up”. These discarded ideas could reside within the relationship Frow (1986) describes as being between the “seen” and the “unseen”, or “that which is missing from the prior text” (pp. 24-25).

Of course, this approach is not limited to the discards from the realms of the science laboratory, but could have positive implications in other fields of human endeavour, particularly as innovation and lateral thinking seem to be the buzz words of the early twenty-first century. It is interesting to note that, although many participants suggest that the most successful collaborations are initiated by artists, McIlte and McLachlan were looking for alternative activities to interact with their professional commitments. They are among those who originated the thread that weaves through this research about the opportunities presented by the "gold dust" that could be found among the "discards" of others.
Looking forward

Biotechnologically based art has already made a considerable "critical intervention" to contemporary debates, claims Punt, but, despite the interaction, this does not indicate that artists are "‘doing science’ or vice versa" (Punt, 2001). Wilson argues that artists require the necessary education to develop roles as artist and researcher, rather than to engage with science and be seen by scientists as a "dilettante".

At the same time [as working with research], artists must keep alive artistic traditions of iconoclasm, critical perspective, play, and sensual communication with audiences. They must be willing to undertake art explorations that do not neatly fit in historically validated media and offer their work in new contexts. (Wilson, 2002, p. 40)

Hill indicates that a useful "idea" is a legitimate research outcome.

New knowledge is a crucial outcome of the research activity. It is not a machine, or a sculpture, or a piece of medical equipment or a painting, but an idea which may be embodied in all such things, and which can be repeated. (Hill, 1995a, p. 12)

But Hill adds a rider. He proposes that the "unique ‘unrepeatable’ artwork" sits beside the "idea" and that "one can aim at repeating sensations", an outcome that would blend research with development. Taking Leonardo’s Mona Lisa, 1506, as an example, Hill argues that the innovative ideas, the research, “those repeatable elements concerned with picture-making, such as the rendering of mass through tonal values, or the suggestion of depth by means of atmospheric perspective”, which led to the creation of the painting, have been subject to repetition since the Renaissance (Hill, 1995b, p. 28).

In 1997, UNESCO held a summit to progress recommendations made in 1980 concerning the status of the artist. The comprehensive document covers aspects raised during the interviews by many of the participants. Topics such as the encouragement of creativity, creative diversity, funding, cultural policy, career paths, artistic education and training, new technologies, intellectual property, remuneration, taxation, and health are all broached (UNESCO, 1997). Australia has progressed some of the fifty recommendations, but others need to be advanced.
Summary

Australian Government representatives assert that artists are imbued with the ability to see things differently, and can interpret, critique and encourage cultural innovation. In view of these perceived attributes, the government has proposed a programme to ‘re-position’ artists to enlist their expertise in the communication of science. However, if artists are ‘by their very nature different’, as the Australia Council recognises, or idiosyncratic as folklore indicates, implementation of this policy could diminish the very qualities the government agencies wish to harness. For example, artists whose practices are bound by government policy or funding requirements could find the freedom they are presumed to have, and which is envied in some other quarters, restricted. The tension between the intent in the Australian Government’s proposal and the actuality of the dynamics that operate in a professional art practice is typical of a dialectical process in train, and the outcome is yet to be revealed.

Artists are also described as idiosyncratic, which is interpreted as irresponsibility by some and as a symptom of lack of restraint by others. This is balanced by the view that artists appear to endeavour to achieve, concurrently, many and various difficult goals. Perhaps it is this suggested complexity of tasks, and resistance to categorisation, that leads some participants to hesitate to nominate specific roles for artists because they consider that artists’ functions in society are difficult to define.

The preferred level of veracity in the communication of information about sci-art exhibits to the public appears to be difficult to judge, and participants express concern that an extensive explanation could lessen the impact of the work. Although artists are not usually qualified to establish scientific facts, participants believe that, in some instances, art work can help the viewer interpret scientific data. Wilson (2002) argues that scientists are more likely to regard artists seriously, rather than as dilettantes, if artists acquire the necessary education to be respected as researchers. However, some participants recommend that a new understanding, supported by a new language, is necessary to enable sci-artists to communicate with the audience. That aside, art is a visual language and sci-artists who feel the need for a new language perhaps would benefit from a more extensive knowledge of the advantages art offers as a form of expression, and the skills required to achieve this expression.
A new language would take time to amass, but the seeds of its inception are indicated in the work of Ascott (1997) who has initiated a new vocabulary for new media (see Appendix C).

In several quarters, the science associated with many sci-art projects is regarded as 'soft', and, even in some highly publicised examples, projects are sometimes based on technologies that have been available in laboratories for several years. Indeed, sci-art's potential multidimensionality offers artists opportunities to exhibit the work as a product, as illustration, as art, as entertainment, as a tool for instruction, or as an amalgam of all of these factors and possibly others.

A common response to the dense didactic panels and essays that frequently accompany contemporary art exhibitions of all genres is that these texts tend to alienate and to confuse the viewer, and often convey an elitist attitude. Some participants are concerned that, if an over-abundance of analysis and information is provided, the audience could fail to engage intellectually with the art and limit the deliberation they are prepared to allocate to the work, and, therefore, merely accept the interpretations presented by others. Internationally active professional artists are aware that any background information provided is often separated from the work after the initial exhibition and, consequently, the art needs to 'work on its own terms'.

Difficulties in defining and quantifying the quality and level of interaction by the partners in sci-art collaborations could contribute to the lack of consensus among participants on whether artists contribute to the debate about new technologies. Cats and Zurr clearly regard their 'semi-living' sculptures and other sci-art as encouraging debate about new scientific and medical technologies. Some commentators agree that their work, and that of other selected bio-artists, generates awareness of serious ethical questions that warrant community debate, and is, therefore, a tool for critique and possibly change.

However, Verwoert (undated) suggests that the promotion of interdisciplinary collaboration is in keeping with the contemporary economic rationalist economy, and that a consequence could be the controversial 'remodelling' of the role of the artist as an expert. This proposed redefining of artists as experts would, for some, shift the focus of art practice and is another indicator that art practice is on the threshold of change. In a similar vein, Cleworth suggests that countries use large events, such as
the Venice Biennale and Documenta, to present artists with strong social or cultural agendas, and that this tends to present the art works as commodities or cultural products. In addition, he contends that connections with government or large institutions that fund prominent events is seen by some as an imprimatur that the artist is ‘cutting edge’, although the pursuit of such a connection could encourage conformity and undermine the initial aims and intent of the artists involved.

According to the participants, in addition to their communication skills, artists can work in many ways. These include the critique of political, social, cultural and philosophical issues and the perceived boundaries that characterise those issues; and the creation of work that is engaging, controversial and challenging in order to question new and pre-existing conditions and to encourage cultural change. Some participants suggest that even ‘bad’ art, and disturbing images, are acceptable if they provoke a response from the audience, but others describe questionable, confronting and repulsive exhibits as counterproductive. Artists who take up the challenge to push boundaries frequently face difficulties with authorities who do not wish to see the status quo tested. Indeed, House-Honegger (undated) suggests that artists have the only independent voices in some countries today.

Characteristics identified in the research that encourage good, challenging art include a high level of professional integrity on the part of artists; a willingness to push work to a higher intellectual and creative level; a willingness to add curiosity and fun to the process; and a connection with the community to inform them and their work. However, the inquiring artist could find that unwelcome attention emanates from suspicions about the artist’s intentions and the materials and technologies used. The research substantiates the observations of many professional artists who are aware of the impact their choices of media have on the interpretation of their concept, and on the life and success of their work, but also that an over-emphasis on materials and technologies can prove counter-productive.

Other observations include the following: scientists and artists both experience the phenomenon of the ‘wow’ factor or ‘aha’ moment; artists (and possibly scientists) need to know when to allow the work to ‘take over’; a great work of art has magic; artists report sensing that their inanimate subjects return their gaze; an artist needs to earn legitimacy; a scientist’s view is subordinate to those of society; and a society needs art to sustain its health as a civilisation.
History has provided examples of prescient artists who had the ability to visualise concepts and phenomena before their existence and/or configuration was established by science. Their ability is attributed to an awareness of the prevailing paradigms and interests of the society in which they lived, essential for an informed or prepared mind. Similarly, throughout this thesis, reference is made to the notion that artists and scientists can, on occasion, benefit from re-examining concepts, incidents and observed phenomena that were not explored fully, or were regarded as insignificant, by others at the time. As the participants put it, an important role for the artist is to address issues that defy understanding and to try to visualise those concepts for their communities so that that which is not necessarily present or visible, is created. Merleau-Ponty (1964) describes them as the properties within the things themselves. Others describe them as the 'in between'. In this study they are referred to as the 'discards', the unorthodox or 'discarded intellectual matter of others'.

Many of these varied roles advocated for contemporary artists link them with dialectical processes: artists would be engaged in pursuits that encourage tensions between existing paradigms; that require an engagement with multiple layers of meaning and understanding; and, in some cases, that have the potential to move prevailing attitudes and practices to other levels of sensibility, commitment, meaning and purpose.
Endnotes

1 Consciousness Reframed conferences were established by the Centre for Advanced Inquiry into the Interactive Arts (CAiiA), at the University of Wales, founded by Roy Ascott and others. The Centre has been renamed the Planetary Collegium.


3 Stuart Purves is the proprietor of the Australian Gallery, Melbourne, and, at the time of the interview, President of the Australian Commercial Galleries Association.

4 Jan Verwoert studied cultural studies and philosophy in Hildesheim and London. He now lives in Hamburg and works as an art critic for, among others, Frieze, Springerin and Camera Austria. He was awarded the prize for art criticism by the Association of the German Kunstrevidne in 2001.

5 Steve Kurtz is Associate Professor in the Department of Art, at the State University of New York’s University at Buffalo, and is a member of the internationally recognised Critical Art Ensemble.


7 “HAARP is a scientific endeavor aimed at studying the properties and behavior of the ionosphere, with particular emphasis on being able to understand and use it to enhance communications and surveillance systems for both civilian and defense purposes”: from the HAARP website: http://www.haarp.alaska.edu/haarp/hPurpose.html, accessed June 09, 2004.

8 Baroness Greenfield, a neurobiologist, is a prominent science communicator.

9 Su Baker, Mis-en-Scene, John Curtin Gallery, Curtin University of Technology, Western Australia, 25 June – 08 August, 2004. The exhibition is part of her submission for the award of Doctor of Creative Arts. Baker is the Head of School of Art, Victorian College of the Arts, Melbourne. Baker is cited in Chapters 4 and 11.

10 Queiroz-Conde’s PhD studies the structure of turbulence. His article in Leonardo examines the link between the geometry of turbulence and painting.

11 German anatomist, Professor Gunther von Hagens, exhibited Human Body Worlds in Japan, Germany, Austria, Belgium, and England (2002). The exhibition comprises human bodies that have been treated by a process called ‘plastination’.

12 Mitchell explains the “dialectical tension” he hypothesises resides within the term ‘biocybernatic’ as follows: “Cybemetics come from the Greek word for the ‘steersman’ of a boat, and thus suggests a discipline of control and governance. Norbert Wiener called cybernetics ‘the entire field of control and communication theory, whether in the machine or animal’ (OED: 1948). ‘Bios’ on the other hand, refers to the sphere of living organisms which are to be subjected to control, but
which may in one way or another resist that control, insisting on 'a life of their own.'" (Mitchell, 2002, pp. 10-11).

13 UNESCO, the French Ministry of Culture and Communications, and the Getty Conservation Institute organised a summit at the UNESCO Headquarters in Paris, in 1997, to re-address recommendations made in 1980 concerning the status of the artist. Many of these issues surface again in the interviews for this research.
CONCLUSION

This thesis investigates the role of the artist at the beginning of the twenty-first century. It also sets out to identify dialectical processes that have occurred between art and science, particularly due to new developments in biotechnology that have emerged since the latter part of the twentieth century.

Critical qualitative inquiry provides for an eclectic, post-structuralist approach, and the methodology, methods and philosophy maintained throughout the study reflect the interdisciplinary nature of the research, as does the selection of scientists and artists as participants. The semi-structured interviews proved to be an appropriate method for garnering contemporary views on the questions submitted to the participants, and, in addition, allowed opportunities for comments on issues not directly canvassed. Due to the stature of the participants within their professional communities, they are ideally situated to inform the research. The veracity of the interview data was ensured by submitting the transcripts to the participants for verification prior to their contents being included in the research analysis process.

The additional topics raised by the participants, typical of the non-linear approach that critical qualitative inquiry engages, and their wide ranging responses, required a multi-linear analysis that allowed me to develop a degree of cohesion for discussion. Consequently, the analysis process began with pattern analysis, a useful tool in such situations, and the results of that process guided the selection of the subject matter for each chapter and the structure within the chapters. In this way, and following the recommendation of Greene (2000, p. 988), it was possible to tease out many complex and interrelated issues into coherent frameworks rather than endeavouring to lock the debate into "any singular philosophy or approach". Where necessary, cross-references are supplied in the thesis. It is important to note, however, that the complexity of the competing issues and responses was compounded by the number of individual theories the participants brought to the research.

To my knowledge, this is the first in-depth study that incorporates the views of contemporary collaborative sci-artists and non-collaborative artists and scientists.
in order to collate and analyse their opinions on the role of the artist at the beginning of the twenty-first century. In view of the participants' knowledge and involvement in the research area, and the forward moves many of them have made in their career paths since the interviews in 2003, I recommend that follow-up research be conducted in 2007 or 2008 in order to ascertain any changes that they have observed or experienced. This is pertinent due to several situations identified below, where, in my view, current circumstances are in a state of flux and significant changes could occur in the near future.

In order to focus the arguments, a search for and analysis of dialectical processes, both in an Hegelian triadic form and a poststructuralist approach, are conducted and reported in the chapters. Each chapter summary examines the material from the chapter in relation to the theories expounded in Chapters 1 and 2. This conclusion draws together and explores potential tensions and instances of dialectical processes that range across all the chapters.

In contrast to the triadic formulation which seeks a thesis, an antithesis and a synthesis, a poststructuralist approach seeks 'rhythmic' layers of understanding. Frow (1986) describes it as interpreting the connection between that which is 'seen' and the 'unseen' (pp. 24-25). In accord with both Frow and Docker (1994), I found that elements within the connections or relationships the participants propose 'shift and slip' according to the individual interviewee's background and philosophies. As a consequence, the multi-linear approach supported by a poststructuralist methodology proved a constructive framework for the study. Although the research locates some instances of dialectical processes, these processes have not emerged as the dominant issues I had hypothesised, and I found much that is complementary between science and art. Nevertheless, the instances of dialectical processes in the relationships between art and science cannot be ignored and signal possibilities for change.

The discussion of the perceived similarities and dissimilarities between science and art that emerged is an example of the benefits of the semi-structured interviews. It appears to me that the subject of similarities and differences between art and science constantly lurk below the surface of debate, possibly in response to the frequent references to Snow's mid 1950s idea of 'two cultures' that appear in recent relevant literature. Indeed, the research finds that the similarities far outweigh
the dissimilarities predominantly in the area of the philosophical attitude that both scientists and artists bring to their practices. The findings, therefore, challenge previous beliefs that art and science are distinctly separate disciplines, and indicate that sci-art collaborations play an important part in the breaking down of antipathy towards interdisciplinary activity between scientists and artists. In addition, engagement in collaborative projects has proved propitious to the 'debunking' of stereotypical myths surrounding scientists and artists, according to participants, although the arrival in a laboratory of some artists has been greeted with scepticism and negativity. Their interaction, or clash as the proponents of the two cultures theory could claim, caused the two disciplines to both collide and collaborate. In some instances, this has precipitated attitudinal change and a wider appreciation of the qualities of the parties concerned. This dialectical process is set to continue.

One example of a wider appreciation of the potential of art is McLachlan's acclaimed incorporation of artworks, and images of art, in the structure of his lectures to medical students. His innovation, a result of his collaboration with Storey, has set a new benchmark for lecturers in medicine, and signifies an example of a tension between traditional and new methods of teaching that has precipitated positive outcomes.

However, for scientists, an engagement in a sci-art collaboration does not necessarily enhance their career prospects and, in some cases, could be regarded as detrimental. In contrast, for artists, the perception exists, in some quarters, that a sci-art collaboration could assist their practice to appear cutting-edge and 'sexy' because it involves new materials and technologies. Nevertheless, the products of scientist and artist collaborations are not regarded as successful by all the participants. The activities which attract the most disapproval are those in which the artist merely illustrates the scientific concepts rather than engaging with the scientist in discussion and critique. Participants claim that this illustrative work is frequently associated with 'soft' science, fails to acknowledge the 'real value' of art and science working together, and trivialises both science and art.

Upon consideration, this negativity towards work that illustrates science requires the researcher to "embrace ambivalence" as proposed by Lunenfeld (1999, pp. xiv-xv). On the one hand, scientific visualisation, particularly in areas such as space exploration, chaos theory and fractal geometry, is bringing images - beautiful
images – to the public that enhance the community’s access to an understanding of scientific concepts. On the other hand, sci-artists, whose works ‘die’ at the end of an exhibition, also rely on photographic documentation to disseminate their work after the event. Although some participants discount the value of ‘illustration’, it appears that a meta-discipline of scientific visualisation could emerge and that sci-artists will need to be on board.

At the outset, it was made clear that this thesis does not attempt to define what constitutes art, but some participants reveal their ways of thinking about works of art. Accordingly, it appears that some time honoured thoughts on the quintessential elements of a work of art, including an impression of time spent and time captured, and sensations of stillness, mystery, magic and/or transcendence, continue to pertain at the beginning of the twenty-first century. The proposed relationship, wherein the artist’s creation transcends work that was achieved previously, could be regarded as dialectical as the work is considered to have moved to another level of creativity. This continued regard for the elements attributed to art is a quality that many new media proponents wish to access for their new practices, but do not particularly wish to acknowledge, an anomaly that is discussed below.

The resurgence of beauty as a component of contemporary art exhibitions, highlighted by art critics, could be cyclical, but, that aside, it could represent a dialectical response prompted by the graphic images in the mass media of violence due to war and other civilian tragedies, and ‘natural’ disasters. History shows that artists respond to different world events in different ways, and previous periods of conflagration and despair, such as the depression during the 1890s and World War I, were followed by radical art in the form of Surrealism, Dada and Cubism. The recent return of beauty is one of the indicators of change, a possible instrument for a movement of understanding, located in this research that signal that art is in a state of flux. The reason for the resurgence of expressions of beauty in contemporary art could provide a subject for further research.

In contrast to the resurgence of beauty in art, some proponents of new media contend that their diverse practices have finally accomplished the death of traditional art, and that a new definition of an art masterpiece will need to be established, along with new criteria for art’s evaluation. The proposal that traditional art has, at last, met its antithesis in new media, suggests the possibility of a dialectical process. However,
although Cats asserts that science and technology are the key components of “development of twenty-first-century society” and that artists cannot ignore this fact and continue “painting landscapes forever”, most of his fellow participants do not equate professional artists with “painting landscapes”. They emphasize that contemporary professional artists challenge and critique social and cultural issues and have a role to play in debate, a role that Cats and Zurr encourage in their practice. Indeed, some participants stress that artists who do not engage in contemporary debates on issues of importance will find their work regarded as irrelevant.

Ambivalence emerges between the claims by new media proponents of the death of art, and their wish for a theoretical and art historical framework to overcome the curatorial difficulties they claim disadvantage the exhibition of their work. If new media artists consider it advantageous to them, in some way, that the appreciation and importance of traditional art forms are diminished within the community, one could argue that a theoretical and art historical framework would be of little value in mediating their curatorial concerns. Sci-artists also face strong competition for recognition from their new media cousins, such as digital and technologically based art. One benefit that could accrue from this research is a wider appreciation of the activities and intentions of collaborative artists and scientists.

An issue for both conventional and new media artists, according to the research, is the problematic trend towards the difficult, inaccessible didactic panels and essays that accompany many contemporary art exhibitions. The participants suggest that, for a general audience, complex texts tend to alienate viewers, to seem elitist, and to negate the efforts of the artist to engage the audience’s involvement in interpreting the work. Many experienced artists understand that art work needs to be able to ‘stand on its own’. Two participants suggest that inaccessible work, and particularly that of controversial celebrity artists (which one describes as ‘middle class nonsense’), becomes irrelevant, and the careers of other contemporary artists could suffer if the public assumes that all contemporary art is similarly obscure and elitist. This move to question the didactic practices that dominated the end of the twentieth century is another example of attitudinal adjustment that foreshadows art as a discipline at the threshold of change.
That aside, participants point out that certain members of the public may welcome texts that explain challenging art, and that art exhibited without a philosophical or theoretical framework could be labelled entertainment, in contrast to the work of scientists which is accorded an aura of importance by many in the community. As one artist participant observes, it is frequently the packaging of the work that determines its marketing and contextualisation, a factor of which artists of all persuasions need to be aware.

Sci-art practitioners are also confronted with the dilemma of the extent to which factual scientific information is needed to facilitate viewers’ understanding of their work. Some participants suggest that it is not the role of the artist to determine the veracity or otherwise of the scientific concepts, but to provide objects to stimulate debate. Other concerns raised include the costs of mounting a sci-art exhibition, and the (unlikely) possibility of biological terrorism and dangers to public safety linked to the use of hazardous materials. Traditional artists also face immense costs to mount an exhibition. The research suggests that both traditional and new media artists could benefit from an exploration for alternative innovative exhibition spaces, another movement towards change.

In their discussion of the avant-garde, some participants observe that, at the beginning of the twenty-first century, art that is described as ‘radical’ when first exhibited is often not regarded as confrontational or challenging for long. Rather, it is quickly assimilated into the mainstream and becomes entertainment. However, a dialectical process is associated with the notion that the avant-garde has a role to provide aesthetic experiences to address (or provide an antithesis to) changes in sensory perception occasioned by the tendency for the mass media in a capitalist culture to encourage mediocrity.

The advent of new technologies has historically heralded a period of heightened artistic activity, and the new materials, such as stem cells, have facilitated the creation of ‘semi-living’ sculptures and other innovative creations. These developments reflect dialectical processes in that they provide artists with new materials with which to work and, thereby, move their art practices into an area of new skills, concepts and influence. These practices, and their outcomes, become a hybrid between art and science. At the same time, sci-artists could unwittingly promote the assumption that disquiet, scepticism and debate about stem cells, genetic
modification and other recent biotechnological developments are unwarranted because the results of these developments are innocuous. For example, the creation of 'semi-living' sculptures, such as Worry Dolls, the eating of Disembodied Cuisine at the close of the exhibition, and the use of bacteria to develop 'living drawings', could be seen by some audience members as an indication that these are commonplace materials readily accessible for many purposes, including art. The participants' views did not form a consensus on the extent to which biotechnologically based artists contribute to the debate on scientific and medical issues. That aside, the scientists and artists involved in bio-art collaborations do not regard these practices as merely an aberration in the continuum of art. They suggest that the influence of sci-art has the potential to extend further than is currently appreciated, and, therefore, they intimate that sci-art presents dialectical possibilities for change.

Science and art collaborations blur established boundaries between the two disciplines and one perceived advantage of this is an openness to expressions of intuition and serendipity, and to claims that a critical, receptive mind, one that is open to lateral investigation and fantasy, is beneficial for creativity in both science and art. The recent changes announced by the Australia Council in relation to its new Inter-Arts Office with responsibility for 'hybrid' arts, also reflect the contemporary interdisciplinary attitude and the consequent blurring of boundaries. In addition, the Council's announcement adds credence to my assertion that the arts are in a state of flux and are at the threshold of change.

According to studies conducted by Root-Bernstein and others, cross-disciplinary knowledge and expertise play a significant role in the development of the polymath and successful scientists are highly likely to be very successful in areas of the humanities, such as music, literature and art. These claims raise concerns regarding future opportunities for interdisciplinary studies; for example, art and science, given current trends to 'downsize' the humanities and pure sciences. An investigation into the extent of polymath qualities in high-profile Australians could reward further research and provide data for researchers in the fields of innovation, creativity and interdisciplinary education.

Education in the visual arts is also at the threshold of change. Factors contributing to this instability include the reduction in funds for visual art education
and other areas of the humanities due to economic rationalist policies, the streaming of visual art students in universities towards theoretical studies, and the debate about the value of higher degrees in the visual arts. In 2001, Vesna wrote of her concerns that both the humanities and science were placing theory above practice, and argued that both theory and practice need to be informed by the other. Bernard Smith (1988) and Cleworth propose a way forward but, again, a synthesis is not immediately to hand. Although a cross-disciplinary education could provide research skills for artists who wish to take part in interdisciplinary collaborations, a conflict develops if, as some participants suggest, the result is that they become considered 'experts' in the field.

Participants are clear that technology does not change the creative process but it does provide new tools or vehicles with which to work. However, the research finds that the cost of new technologies makes it more difficult for artists or scientists who wish to engage in these areas to choose to work alone in their laboratories or studios. As a result, 'pure' science or art research could be hindered, and incidences of the isolated 'genius' who experiences the 'aha' or 'eureka' moment may become more infrequent. These ideas, then, link creativity with funding issues, and one participant points out that the most interesting art created during the nineteenth century came from outside the academics and institutions during a period when art did not rely on capital in order to develop. A tension exists here between the need to provide for artists who 'push boundaries' to work outside institutional pressures if that is where they are at their most creative and innovative, and the need to provide for artists whose practices rely on substantial capital and sponsorship, such as biotechnologically based sci-artists. The situation, therefore, is one of instability, and a continuing role for professional artists who work outside institutional systems could be in jeopardy. An equitable solution is needed here if, as Plekhanov (1973) hypothesises, "gifted persons appear" in response to the social and cultural conditions in which they live and work. It would appear that the words of Marx and Engels (1976), cited in Chapter 2, have relevance today: "Whether an individual like Raphael succeeds in developing his talent depends wholly on demand, which in turn depends on the division of labour and the conditions of human culture resulting from it" (p. 417).
The perception that scientists lack communication skills, and could benefit from creative approaches in the dissemination of their research data, was cited as one reason for the encouragement of sci-art collaborations. One commentator claims that science accentuates intellectual communication and art accentuates the communication of subjective knowledge. However, some participants suggest that the successful outcome of collaborations between scientists and artists depends on which party initiates the project and, where the collaboration is initiated by a scientist, they suggest the results are sometimes merely illustration. In contrast, they view artist initiated collaborations as frequently more effective in that they are prompted by curiosity and by the possibilities presented by the new biotechnologies: the artists engage in debate about ‘contestable’ futures. However, unanimous enthusiasm for the results of biotechnologically based art was not forthcoming, nor did the participants endorse the idea that all such art practices are avant-garde.

The participants compare both the positive and negative implications that funding bodies could have on the way scientists and artists approach their practices and on the outcomes of any collaboration, with the benefits such an association could bring. In particular, biotechnologically based artists could find their ability to investigate and critique the scientific and medical developments compromised. The participants recommend that artists address and formalise issues, such as copyright, intellectual property and ethics, and who controls the projected course and outcome of the project, prior to the commencement of all art collaborations, irrespective of whether traditionally or biotechnologically based. The research discourse indicates that dissonance could arise between the desire for creative freedom on the part of artists, and the desire for a particular outcome, either overt or covert, on the part of funding bodies. These perceptions need to be addressed if all parties are to be in a position to achieve outcomes beneficial to the society they, presumably, seek to serve.

Two scientist participants who took part in sci-art collaborations because they were open to innovation and were looking for something different, raised the notion of looking for the ‘diswards’ or ‘things between’, ‘the properties within the things themselves’, to stimulate creativity. The artists interviewed did not raise this notion. This could be because, from my observations, artists tend to take such activities as an integral part of an art practice. Prescient artists are among those who have
purportedly envisaged phenomena prior to those phenomena being confirmed by scientific observation or research, and some participants contend that artists who are ahead of their time can 'almost predict public opinion'. An artist and a scientist noted, however, that cutting edge research is frequently associated with concepts that are initially not fully understood, and answers questions that were not recognised as questions at the time. A search for the 'discards', therefore, has practical and intellectual potential across disciplines and, as such, involves dialectical possibilities. An experience of the 'wow' or 'aha' moment is also common to both disciplines. Although the concept associated with the 'discards' is not new, it remains relevant in interrogative and innovative art and science practices and offers great potential for insightful and exciting developments.

Mindful of some of the characteristics ascribed to artists, including those mentioned in this conclusion, the Australian Government has indicated a desire to 're-position' the artist in a bid to foster the communication of science, innovation and creativity. A policy of this nature could be interpreted as assigning the role of adjunct to artists because their views are not important to the discussion. Government initiatives to remodel the role of the artist could also be counter-productive, impair creativity and raise concerns related to art funding because, historically, artists have withstood any attempts to categorise, to control or to direct their art practices. Nevertheless, the tension between the Government's interest in innovation and the role artists play in the community is stimulated predominantly by the possibilities presented by new technologies. The oft unstable relationships between the government, artists, scientists, and technological potentialities are often, but not necessarily, in opposition, as Popper (1972a, p. 134) allows, and, within a Popperian notion of the dialectic, it is appropriate to question the extent to which a new understanding could develop through the interaction of the aforementioned factors. Commercial interests add another dimension to these interactions, too, and business sees advantages in an association with the art world in the form of an enhanced image and other benefits.

The perception that artists resist categorisation and are frequently occupied with a complexity of tasks could be the reason some participants hesitate to identify particular roles for the artist. However, the research data indicates that artists have a multifaceted role in society and that they may become irrelevant in the twenty-first
century if they fail to engage in debate on issues that affect the community in which they live. For example, artists are in a position to identify and critique controversial technological developments; to comment upon political, social, cultural and philosophical issues; and to ‘see differently’, such visualisations enabling their audience to access different perspectives. However, in order to fulfil these roles, artists need to maintain a high level of integrity to themselves and to their creative processes, notwithstanding the tensions, outlined above, that surround their practices at the beginning of the twenty-first century.

The findings of this study suggest that art is on the threshold of change, but that the change is not necessarily precipitated by sci-art collaborations. Indeed, it is appropriate to question whether sci-art will maintain its self-proclaimed role as agent provocateur or whether it will be subsumed into the mainstream as has occurred with other radical forms of art in recent years. Another anomaly observed in the data is the funding and organisational support provided to biotechnology-based artists in comparison to artists with more traditional practices, notwithstanding the fact that the former engage with a minority audience. In addition, the dialectical processes located by the research are, again, not all prompted by movements in the relationship between science and art: among other influences are governments and established institutions, funding, education, and cultural and social issues. The research has provided a forum for scientists and artists to assess their roles in relation to these bodies and influences.

Clearly, the role of the artist at the beginning of the twenty-first century is at the threshold of change. Many of these changes involve multi-variate factors and influences: for example, governmental and institutional programmes that encourage innovation and creativity offer advantages and, in some instances, financial support to scientists and artists who become involved. However, the programmes also bring potential disadvantages in that they could stifle spontaneity, creativity and investigative research. Interdisciplinary education also offers advantages to students and the wider community, and, in particular, a cross-disciplinary approach could enhance the likelihood of increasing the number of polymaths in the future. Nevertheless, there are tensions and concerns in education circles in relation to funding cuts, the relevance of some new higher degrees in the visual arts, and the manner in which visual arts students are streamed. These instances, and others
discussed in this thesis, characterise the indeterminate nature of many of the issues confronting science and art today. Whatever the case, while the research has raised many ambiguities, perhaps the only consistent finding is that the collaborative interaction between artists and scientists is a non-linear process and, because of the malleable contemporary boundaries of both disciplines, the potential exists for further beneficial interaction. However, artist and scientist participants alike convey the perception that both disciplines are expected to continue to confront, and to express their responses to, challenging issues, and that they anticipate that artists will have an important role to contribute to the debate about social and cultural concerns in the foreseeable future.
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APPENDIX A

STATEMENT OF DISCLOSURE

Phone: (08) 9780 7819 (Postgraduate room)
Email: jdroche@student.ecu.edu.au

To Participant

Dear .............

Research Title:

The role of the artist at the beginning of the twenty-first century: An exploration of dialectical processes in art and science with particular reference to biologically based art.

Thank you for indicating that you are prepared to participate in my research for the degree of Doctor of Philosophy at Edith Cowan University.

The research to be undertaken examines the role of the contemporary artist and the influence of the interaction between art and science on that role. The methodology is based on the dialectic and explores the use of conceptual thought, particularly in the area of biologically based art, and the theoretical and philosophical relationships between art and science. A copy of the research proposal abstract is attached.

The research data will be gathered through interviews with artists and scientists. The artists will be selected from those who work in biologically based art, and artists with "traditional" art practices. There will be at least three artists from each category. The scientists will comprise those who collaborate with artists, and others who do not participate in such collaborations.

It is anticipated that the information gained from the research will facilitate debate on the role of the artist in the contemporary worldview. In addition, the research findings may inform future discussions on the education of, support of, and attitudes towards artists, and the expectations and responsibilities of artists, in a rapidly
changing world. The knowledge acquired during the research in respect to contemporary artistic creativity, and to the interaction between art, science, and technology, will contribute to a rapidly expanding new paradigm in these fields.

Please indicate on the Informed Consent Form if you wish to vet the transcription of the interview to indicate comments which you do not wish to be attributed to you in any publication of the data.

To provide a context for your comments, I would appreciate your supplying me with a curriculum vitae. This information will be published as an appendix to the thesis document. During the research process, and for at least five years following the completion of the thesis document, the interview tapes, transcriptions, and other confidential material will be held in a secure environment at the Edith Cowan University, Bunbury Campus. After that period, the tapes will be erased and destroyed along with the transcripts and other confidential documentation.

The interview would require approximately one hour of your time. If you have any queries please do not hesitate to contact me. However, if you have any concerns about the project and would like to talk with an independent person, you may contact Dr K Robinson, Associate Dean, Research and Higher Degrees, Edith Cowan University, South West Campus (08) 9780 7794.

Thank you.

Yours sincerely

Judith Roche
PhD Candidate
Edith Cowan University
Faculty of Regional Professional Studies
Bunbury, Western Australia, 6230.
APPENDIX B

INFORMED CONSENT FORM

The role of the artist at the beginning of the twenty-first century: an exploration of dialectical processes in art and science with particular reference to technologically and biologically based art.

I, ................................., have read the abstract relating to the proposed research, the title of which appears above, and the Statement of Disclosure dated .......................... Any questions I have asked regarding the proposed research have been answered to my satisfaction.

I agree that the research data gathered for this study may be published in a doctoral thesis, book chapters, and papers in refereed or non-refereed journals, understanding that I will be identified. I also agree that the information in the curriculum vitae that I provide may be included in the thesis document to establish a context to my comments.

I understand that I will be interviewed and the interview will be audio recorded. In addition, I understand that, during the course of the research and for at least five years following the completion of the research and the finalisation of the thesis document, the interview tapes, the transcripts of the interviews, my curriculum vitae, and other confidential documentation will be stored in a confidential environment at the Edith Cowan University, Bunbury Campus. The Edith Cowan University will destroy the interview tapes, transcripts, and other confidential documentation after no less than five years have elapsed from the date of acceptance of the doctoral thesis.

I agree to participate in this activity, realising I may withdraw at any time.

Please indicate as appropriate: I wish/do not wish to vet sections of the thesis where comments are attributed to me.

Participant: ................................ Date: ................................

Investigator: ................................ Date: ................................
APPENDIX C

GLOSSARY OF NEW MEDIA TERMS

The definitions and terms in this glossary were coined by Roy Ascott, Founder of Planetary Collegium, in 1997, and were retrieved November 29, 2004, from:

Art: While traditionally art was focused on the appearance of things and their representation, artists now are concerned with processes of transformation, construction and emergence.

Aesthetics: The classical concern with the surface image of the world gives way to the technologic aesthetics of creative consciousness and artificial life.

Art Gallery: The artist’s window on the world now becomes a doorway into dataspace. As the gallery changes from showcase to operations centre, the museum must become a collaboratory.

Author: The designer of contexts for noetic navigation, and of open-ended, evolutive systems in the Net.

Behaviour: Classical Aesthetics dealt with the behaviour of forms, Technologic Aesthetics deals with forms of behaviour.

Biohaus: We need a biology of building. Seeding should replace designing, buildings must be planted and allowed to grow.

Body: The site of bionic transformation at which we can recreate ourselves and re-define what it is to be human.

Connectivity: Connectionism is the way of cognitive scientists, connectivism is the way of the technologic artist. They converge where the artificial collaborates with the natural in a new synthesis of being.
Cyberception: The emergent human faculty of technologically-augmented cognition and perception.

Cyberself: We are each made up of many selves: de-centred, distributed, and constructively schizophrenic. We are the embodiment of technostic relativity.

Design: Design was always a top down affair with blueprints, master plans and models. Now it's a bottom up process, its algorithms growing in a telematic substrate.

Double Gazing: We see, hear, and feel in ways unknown to biological man, just as the environment increasingly hears, sees and feels us. With retina-tracking lasers, the artist's gaze is returned; the walls have ears, and buildings speak volumes.

Five-fold path: Connectivity, immersion, interaction, transformation, emergence.

Galatronics: The technological amelioration of planetary life.

Holomatic: The holomatic principle is that each network interface is an aspect of a telematic unity: to be at any one is to be in the virtual presence of all others throughout the network.

Hypercortex: The global network of collective cognition. Superthought comes from its community of mind, wisdom from its hyperstructure of experience.

Immateriality: The dematerialisation of art, telemedia and virtual reality leads inexorably to the re-materialisation of culture in the form of artificial life.

Interactivity: The trivial form is a closed system with a finite data set. The non-trivial form has the open-ended capacity to accommodate new variables.

Interspace: Between the virtual and the actual, where reality is renegotiated and the new consciousness is embodied.

Interstitial practice: Art located at the meeting point of bioelectronics, nano-engineering and the science of consciousness.
KI: Consciousness in artificial systems, machines and architecture. The Japanese know this spiritual energy to be intrinsic to technology.

Mysteries: The systems study of mystical consciousness, in architecture, iconic and ritualistic form.

Nanotechnology: Tools to re-materialise art from screen-based media to world-based artificial life, where atoms replace pixels.

Noetic networks: Our personal neural networks merge with global networks to create a new space of consciousness.

Paramentation: The cerebral activity of collective intelligence.

Paranature: Absorbs, recontextualises and goes beyond Nature, technologically assisting in its many inadequacies.

Photomutation: In the multimedia culture the silence of the lens may go the way of the early movies: mute images will mutate to the sonic state.

Post-photographic practice: The digital camera is a tool for constructing reality not for reflecting it.

Psibernetic phenomena: The human desire for transcendence takes many forms: telepathy, telekinesis, out of body experience. Now we have telematics, telepresence and the aesthetics of apparition.

Radical Constructivism: Forget representation, think only of connectivity, complexity and the construction of reality.

Sentient Net. The conscious Net is the feeling Net. In artificial systems, only emotional intelligence can produce truly augmented thought.

Shamanics: Foregrounding the semantic aspect of shamanism in the technoctic context.

Smart Architecture: To support the realities of cyborg living, the distributed self, and our technoetic ecology, architecture will have to become more conscious, anticipatory and responsive.
Structural Analysis: Psycho-therapy for intelligent buildings may be more appropriate than putting ourselves in analysis. Think of all the psychotic and schizophrenic places you know.

Technoetic Art: The technology of consciousness provides the substrate from which a new art is emerging.

Telematic Imperative: When there are no more geographical boundaries, territorial aggression is as irrelevant as polarised politics. The only imperative is to connect. Nowadays even the self is permeable.

Telemantics Net Semantics: the creation of meaning in cyberspace.

Telepresence: Just as telepresence gives us a new sense of self, so our consciousness accelerates to a higher state of prescience: telepresence. It means that we anticipate faster and foresee further.

Telenoia: Telenoia celebrates the networked consciousness of global connectivity. It replaces the paranoia of the old industrial culture: anxious, alienated, secretive and neurotically private.

Variable Reality: Dry Reality is found in the arid space of vr. Wet Reality is the nature we nurture. Moist Reality emerges from the biotechnology of artificial life.

Wormhole: Intrinsic to hypermedia in cyberspace, the wormhole also is as essential a requirement of urban systems as of galaxies, facilitating our passage between real and virtual spaces, and between natural and paranatural worlds.

Zen: The new necessity in art of watchful preparedness: standing back in a Zen-like state of readiness to allow new ideas and forms to emerge from the hyperconnectivity of the Net, then to cultivate, nurture and re-seed them.

The following definition of moistmedia is quoted from Roy Ascott’s speech at the Planetary Technoetics: art, technology and consciousness conference, University Paris 8 (LabArt), November 28, 2001. The definition was repeated in Leonardo (2004) Vol. 37, No. 2, pp. 111-116.
Moistmedia: in its strictly technological form Mixed Reality is in many ways a rehearsal for the truly enormous changes that lie ahead as the dry digital technologies converge, with the biologically wet, producing what I call moistmedia.

Moistmedia arises from the convergence of Bits Atoms Neurones and Genes: the “Big B.A.N.G.” of our post-biological universe. As examples, think of Osaka’s nano-bull, (a three-dimensional model bull just 10 micrometres long – about the size of a red blood cell). Roslin Institute’s lamb called Dolly, Kac’s Alba the fluorescent Rabbit, Robokoneko, Starlab’s kitten, or Steve Grand’s robot baby orangutan, Lucy. Relevant here too is the work of Oron Catts and Ionat Zurr of Tissue Culture Art in Perth, Australia, and Ulrike Gabriel of Berlin. They are the harbingers of the re-materialisation of a culture which earlier we thought would be totally immaterial and virtual. It’s a matter of “bye-bye Baudrillard”. Also, we might add that, at the level of Hollywood, and its influence on popular consciousness, the movie AI should not be ignored, with its rubric: “his love is real but he is not”. (Ascott, 2001a)
APPENDIX D

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PICA
Media-Space
Fibreculture
Arts Research Network
Experimenta
Sound Culture

Public Funding Partners

ArtsWA
Government of Western Australia
LotteryWest
Australian Government
Australia Council for the Arts
Australian Government and the Government of Western Australia: The Visual Arts and Craft Strategy
Government of Western Australia
EventsCorp Western Australia

Major Sponsors

Computronics
Jumbo Vision International
Western Australian Museum (Maritime)
Moores Building Contemporary Art Gallery
Square Peg Design
Technology Park

Supporting Sponsors

Artrage
Art Gallery of Western Australia
JVC
Digital Junction
NEC: Empowered by Innovation
HTPC: Home Theatre Personal Computers
Department of Culture and the Arts: Government of Western Australia
State Library of Western Australia
APPENDIX E

GLOSSARY OF ACRONYMS AND TERMS IN THESIS

AbaF: Australia Business Arts Foundation.
AC: Companion in the Order of Australia. The Order of Australia has four Honours:
Companion in the Order of Australia (AC)
Officer in the Order of Australia (AO)
Member in the Order of Australia (AM)
Medal of the Order of Australia (OAM)
AC4CA: Australian Centre for Concrete Art.
ACMI: Australian Centre for the Moving Image
ACSA: Adelaide Central School of Art.
AI: Artificial intelligence.
ANU: Australian National University
ARC: Australian Research Council
BEAP: Biennale of Electronic Art Perth
CAE: Critical Art Ensemble
CERN: Conseil Européen pour la Recherche Nucléaire. The European Organization for Nuclear Research, the world's largest particle physics centre.
CPAI: Creative and Performing Arts Activity Index
CSIRO: Commonwealth Scientific and Industrial Research Organisation, an Australian federal government instrumentality.
DNA: Deoxyribonucleic acid
EAT: Experiments in Art and Technology.
EFTSU: Equivalent Full Time Student Unit.
EU: European Union
FBI: Federal Bureau of Investigation
GFP: Green fluorescent protein
HAARP: High Frequency Active Auroral Research Program, Alaska.
HBR: Harvard Business Review.
HSC: Higher School Certificate.
JTB: Journal of Theoretical Biology.
MAAP: Multimedia Art Asia Pacific.
MCRI: Murdoch Children’s Research Institute, Melbourne.
MEA: Multi electrode array
MEART: Multi electrode array art
MRI: Magnetic resonance imaging.
NAVA: National Association for the Visual Arts Limited (an Australian organisation).
NGV: National Gallery of Victoria, Melbourne.
NHMRC: National Health Medical Research Council
NIMR: National Institute for Medical Research (UK)
NIMRa: National Institute for Medical Research art programme.
OA: Officer in the Order of Australia (See AC above)
PET: Positron Emission Tomography.
PICA: Perth Institute for Contemporary Art.
RMIT: Royal Melbourne Institute of Technology.
Sydney VisLab: Sydney Regional Scientific Visualisation Laboratory.
SymbioticA: the Art and Science Collaborative Research Laboratory, University of Western Australia.
TAFE: Technical and Further Education
TC & A: Tissue Culture and Art Project.
UWA: University of Western Australia.
WAAPA: Western Australian Academy of Performing Arts
yBA: Young British Artists.