

# Chapter 2

## Experimental Creative Practices

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### 1 Introduction

From the earliest human creative expressions there has been a relationship between art, technology and science. In Western history this relationship is often seen as drawing from the advances in both art and science that occurred during the Renaissance, and as captured in the polymath figure of da Vinci. The twentieth century development of computer technology, and the more recent emergence of creative practice-led research as a recognized methodology, has led to a renewed appreciation of the relationship between art, science and technology.

This chapter focuses on transdisciplinary practices that bring together arts, science and technology in imaginative ways. Showing how such combinations have led to changes in both practice and forms of creative expression for artists and their partners across disciplines. The aim of this chapter is to sketch an outline of the types of transdisciplinary creative research projects that currently signify best practice in the field, which is done in reference to key literature and exemplars drawn from the Australian context.

### 2 Art + Science

In his work *Behind appearance: a study of the relations between painting and the natural sciences in this century* Waddington, a biologist writing about painting and natural sciences, suggests that “science is not merely a one-eyed Cyclops” but instead, humans have “innumerable eyes, all yielding their overlapping insights to his one being, that struggles to accept them in all their variety and richness” (1969). It is in this spirit that we set out to address the subject of *Digital da Vinci*—that is to say this chapter discusses creative practices that transcend traditional disciplinary boundaries in the same manner as Leonardo da Vinci—working across art, science and technology. To approach this subject we turn to the field of art-science, and consider this field from the perspective of literature on the philosophy of science,

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experimental art, and interdisciplinarity. In this vein there is a focus on practices that do not replicate existing disciplinary forms, divisions of labor, or hierarchies of knowledge, but instead seek new synthesis and negotiate what Barry et. al. describe as “forms of agonism and antagonism that often characterize relations between disciplinary and interdisciplinary research” (2008).

Guattari describes such artistic cartographies as having “always been an essential element of the framework of every society” (Guattari 1995, p. 130). This is no different in science to any other domain of society, and from this perspective contemporary art-science projects that provide one of the more compelling responses to the question posed by *Digital da Vinci*—how can we encourage and empower a new generation of “well-rounded” scholars and students, through unconventional and creative application of computer science? This question will be addressed through an examination of several key Australian examples of art-science projects. The art-science community in Australia is particularly vibrant—considering the size of the country—and actively supported by the Australia Council for the Art, through the Experimental and Emerging Arts program.

Studies of inter and trans disciplinarity provide one way of approaching art-science. In this chapter we will reference two key bodies of work, that of Nowotny (2001) and that of Born and Barry (2010) who extend Nowotny’s work in a way that allows a more nuanced evaluation of art-science projects. The chapter then turns to ask what makes experimental art experimental, and considers this question not from an art historical perspective, but through the lens of the philosophy of science, and specifically in relationship to the history of scientific experiment(ation). Thus reframing the concerns of artists about the instrumentalisation of art when undertaken within scientific paradigm, by articulating this in relationship to the contested relationship between experimenter, instrument/experimental apparatus, and theory see within the broader literature.

Despite questions about the nature of creative experimentation and whether it constitutes research<sup>1</sup>, has been an increased recognition of Artistic Research<sup>2</sup> within Australia over the last 5 years. This has been a result of changes in Government research policy<sup>3</sup> that lead to the recognition of artistic and creative outputs as research outputs. When combined with the discussions on inter/trans disciplinarity, and experimentation, we see that experimental art-science projects engage in a what Willis (2006) describes as ontological design. This we suggest points toward a significant methodological development for Artistic Research more broadly. Similarly such

<sup>1</sup> This debate can be seen in the broader literature on Artistic Research, creative practice-led research, for example Working papers in Art and Design Research, *Art&Research: A Journal of Ideas, Contexts and Methods*. This concern is also echoed in literature focused on innovation and research & development. For example NESTA reports by Bakhshi and Throsby (2010), Bakhshi et al. (2011).

<sup>2</sup> In this chapter the term Artistic Research will be used to refer to creative practices undertaken in the context of research, which is drawn from the work of Coessens et al. (2009).

<sup>3</sup> For example the Australian Excellence in Research policy that recognizes creative works as research output.

an ontological perspective suggests art-science projects may be exemplars of what Bakshi et al. (2010; 2011) describe as innovation through experiment. As a result this chapter aims to present one way of approaching of the epistemic tensions and transformative potentials of the larger *da Vinci* agenda.

### 3 Art and Science—Genealogy of Sorts

Art-Science, and Experimental Art, are not new areas of practice—and both can be positioned in respect to a range of historical threads (genealogies of practice). For the purposes of this chapter, and in line with the focus of *Digital da Vinci* on computer science, we will begin with the movements of computer art, cybernetic art and experimental art—which emerged in the 1960s as a result of the convergence of art and the nascent fields of Information and Communication Technology. These movements are relatively marginal; either being cited in respect to other named movements, or regarded simply as technological experimentation. Yet in the context of this chapter we consider artists working with new technologies mid last century, such as early computers, and exploring the implications of emerging scientific theories as precursors of today’s art-science practice.

Over the last decade there has been a renewed interest in these movements, and a range of publications that map this terrain, for example *Art of the Electronic Art* (Popper 1993), *Digital Arts* (Paul 2003), *New Media in Art* (Rush and Rush 2005), *Art in the Digital Age* (Wands 2006), and *Art and Electronic Media* (Shanken 2009) to name but a few. Similarly there are a number of voices, such as Manovich (2001); Bourriaud (2002) and Quaranta (2010), who have examined the distinctions between contemporary art and New Media Art, and the emergence of a “post-media aesthetic” (Manovich 2001). More recently Bridles’s (2011, 2012) *New Aesthetic*<sup>4</sup> has emerged as a “catch-all” for almost all forms of art and design that involve digital technologies and computation reshaping the aesthetic experience of everyday life—and increasingly life itself. While there has been substantial interest in the ways technology (and science) are changing creative practices and art, new artistic forms and practices related to science and technology have continually struggled to find a place within domains of science or art. This is not so much a result of some form of resistance from the any so called conservative establishment, but is really due to the difficulty in appreciating (valuing) new practices that cross over disciplinary boundaries, or result in new synthesis of disciplines.

Art science is one of those areas that poses such problems. For Born and Barry (2010) the practices and outcomes need to be understood, and valued, in respect to a broader context that encompasses multiple disciplinary perspective and histories. This they suggest includes: conceptual and post conceptual art; historical movement of art and technology; and the broader development of computation,

<sup>4</sup> As documented by Bridle at the following URL: <http://new-aesthetic.tumblr.com/>.

biological sciences and technologies, with an origin in theories of cybernetics. The challenge of understanding such practices is that they do not comfortably fit within a disciplinary framework, and are commonly found outside the normal sites for disciplinary practice. For example the computer artists of the 60s and 70s often found themselves working in newly formed interdisciplinary departments, which had begun to explore the use of computers within an art setting. However, these groups often found themselves outside the normal practices of existing disciplines. Brown (2008) describes one such interdisciplinary group, the Experimental and Computing Department within the Slade School of Fine Art, and the difficulty of artists working in this area in the early 70s to gain recognition within exiting disciplines. However, the work coming from these early interdisciplinary groups was instrumental in the development of the broader field of computer graphics<sup>5</sup>, and has been recognized in retrospective exhibitions<sup>6</sup>. Today this type of practice is described as “blurring the boundaries between genres and disciplines, [as well as] redefining the contexts of use and modes of distribution” (Freyer et al. 2008, p. 10). This is often seen as a result of a continual focus on the “new”—as is suggested in names like New Media Art.

Artists working with new technologies have often been criticized for a form of technological fetishism (Manovich 2003), where the focus on new technology is in part viewed as over-determining artistic practices and outcomes. However, to engage in a constructive reading of such practices requires, as Paul (2008, p. 5) argues, more than a “strictly art-historical perspective.” Understanding the significance of such practices requires an appreciation of the multiple disciplinary trajectories that converse within a specific instance of practice, which draws together fields of science, technology and media theory. This is not to disregard an art-historical perspective, for example authors such as Gere (2008); Popper (1993) and Shanken (2009) trace the lineage of New Media Art practices to the Futurist, Surrealist, Dadist, Fluxus, Systems Art and Cybernetic Art movements of the last century, and note the influence of figures such as Dechamp, Nam June Paik, Cage and Sol LeWit. What emerges from the literature is an appreciation of the diversity of art-science. Art-science spans the full spectrum of both scientific endeavor and art practices—from critical engineering practices of Jerimijenko to the radical post-humanist work of Stelarc and the bio-arts of Kac, Zurr & Catts. These practices are all unique combinations of science and art, which in each configuration draw upon different histories of science and art.

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<sup>5</sup> Computer Graphics is an examples of a field that has been the result of interdisciplinary research—from the early computer artists and researchers working together to develop the potential for new visual technology, to the contemporary animation studios working across Film, TV and Computer games pushing boundaries of the field through creative application.

<sup>6</sup> For example the computer art collection at the Victoria and Albert Museum London, see Beddard (2009).

Much of what is named art-science takes place within a research setting, as is seen in Wilson (2002) survey of what he calls *Information Arts*, in which he outlines several differing artistic approaches to engaging with techno-scientific research. This survey spans scientific disciplines, and concludes that artistic research within art-science takes of different forms, including: exploration of new possibilities opened up by science and technology; critical engagement and questioning of the cultural implications of specific lines of research; the use/application of new capabilities to address themes not directly related to specific science of technology; to the incidental use of technology within practices. (Wilson 2002, pp. 8–9) In the context of this chapter we are most interested in practices which do not simply “use” new technology, but have a critical or applied role in a specific line of scientific or technical research—rather than being a “distant commentator” or consumers of the outcomes of research without taking part in the processes of knowledge creation.

## 4 From Inter to Trans Disciplinary

These types of art-science project exhibit transdisciplinary characteristics, and to develop an appreciation for art-science requires an understanding of the movement from discipline to inter disciplinary to trans disciplinary. As Ox and Lowenberg point out “art-science, refers to worldviews, conceptual systems and research based on equal contribution from differently trained minds.” (2013) In the first issue of *Leonardo*, a journal dedicated to writings about art science and technology inaugurated in 1968, Waddington writes that it would be a “mistake to see the traffic between art and science as one-way” (1968). Yet in outlining this interaction, art and science remained within fixed disciplinary boundaries influencing each other through their expressions. Around the same time C. P. Snow presented his two cultures argument, which marks a moment in recent history cited in much of the literature on interdisciplinarity.

the clashing point of two subjects, two disciplines, two cultures—of two galaxies, so far as that goes—ought to produce creative chances. In the history of mental activity that has been where some of the breakthroughs came. (Snow 1964, p. 6)

Since C. P. Snow’s 1964 two cultures argument, there has also been an increasing focus upon of interdisciplinary. More recently Csikszentmihalyi (1999, p. 314) argues that it is only within interdisciplinary settings where “individuals, domains and fields intersect” that the process of creativity can be observed, is particularly poignant. Carter (2004) suggests that this process of creativity is a form of *poiesis*, or place-making. This he describes as “collaborators plunge[ing] into the realm of Becoming” (Carter 2004, p. 11). The resulting tensions and exchanges bring into question the assumed “natural places of ideas, images and materials” (Carter 2004, p. 11). The outcomes of art-science collaborations are expressions of this

negotiation, as ideas and materials as they are reorganized into creative forms and experiences. This is a shared creative act of placing things back together, a process that Carter argues, produces knowledge through the way collaborators combat the ideological character of their respective disciplinary discourses and myths by inventing artificial myths.<sup>7</sup> This suggests the importance of the arts and creative practice-led research within interdisciplinary collaborations, which Bennett describes as follows.

What is clearer today than in previous generations of research is that the aesthetic (in the fullest sense, encompassing the practical study of affect, sensation, perception, behavior, imagination) is fundamental to any understanding of the connections between lifeworlds, disciplinary procedures and given problems: the arts, in other words, are at the core of the transdisciplinary experiment. (Bennett 2012)

The urgency of the so called “trans disciplinary experiment” is driven by the realization that the problems humanity faces, for example complex health issues or global climate change, are highly complex—even wicked (Horst 1973)—and require the combined efforts of multiple disciplines. As a result most of the work on interdisciplinarity has been focused on knowledge production, aka research, and can be seen across a range of disciplinary areas spanning art, design, social science, engineering, to medical sciences. Much of this writing reflects what Nowotny et al. (2001) describe as the movement from Mode-1 to Mode-2 knowledge production. Where Mode-1 knowledge production focuses on highly specialized disciplinary research, Mode 2 is carried out in respect to application, and involves heterogeneous teams of researchers and partners from multiple disciplines. Nowotny et. al use the prefix trans for Mode 2 knowledge. This form of knowledge production is described as “inherently transgressive” in that it “transcends disciplinary boundaries [...] reaching beyond interdisciplinary to trans disciplinary” (Nowotny et al. 2001, p 89).<sup>8</sup>

Within the literature there is a clear distinction made between multi, inter and trans. Multi and inter disciplinary services the “mutual needs of two disciplines”, while transdisciplinary work “is impelled by external conditions or problems, but also by the conviction that disciplines do not have proprietary rights over their domains” (Bennett 2012). Across the literature there is a shared focus on complex, multi dimensional, highly relational, interdependent problems, which necessitate a methodological approach that transcends the singular foci of existent disciplines. Combined with the general view that the resulting synthesis cannot be reduced or evaluated from singular disciplinary perspectives; a “theoretical, conceptual, and methodological reorientation with respect to core concepts of the participating disciplines” (McMichael 2000)

Art-science is one of the key examples of this type of transdisciplinarity, and to develop an appreciation for the different types and forms of art-science we will employ the framework outlined in the *Logics of Interdisciplinarity* Barry et al. (2008).

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<sup>7</sup> Here Carter is referencing Barthes’ *Mythologies* (1973).

They describe the several logics and three modes that frame and organize practices. The most commonly described mode of practice encountered is referred to as the *integrative/synthesis mode* that is “conceived in terms of the integration of two or more ‘antecedent disciplines’ in relatively symmetrical form” (Barry et al. 2008). The second mode is referred to as the *subordinate/service mode*, where one discipline is in service to another. For example, a technology partner provides a service to an artist, filling a gap based on disciplinary expertise, or an artist is “employed” to visualize scientific data in order to present findings to the public. In both of these instances the partners effort (work) remains within their respective disciplines.

However, not all interdisciplinary collaborations fall into these two modes, a third modes involves a “commitment to contest or transcend the given epistemological and ontological assumptions of historical disciplines” (Barry et al. 2008). This is referred to as the *agonistic/antagonistic mode*, and the mode which most closely reflects descriptions of transdisciplinarity. Many art-science projects exhibit characteristics of this mode, especially where the artistic practices involves a critique, or questioning, of science, or where the working methods of science infect artistic processes and outcomes. Such projects are not easily reduced to the ‘antecedent disciplines’. In other words, something new is born which requires a new frame of reference before it can be fully appreciated and evaluated. These three modes are not mutually exclusive, and many projects display characteristics of more than one—especially the third mode, as this type of critical questioning that is part of the artistic method—as seen in contemporary practices within the fields of conceptual and experimental art.

Similarly, interdisciplinary projects follow a series of different logics, which are often invoked when establishing the rationale and justifications for a project. Barry’s study of interdisciplinary projects, including art-science, shows that many projects follow what they describe as the logics of accountability and innovation. For example there are numerous examples in the literature which position artists and creativity within innovation life cycles<sup>8</sup>, similarly artists work is often seen as providing a form of public account of science (include citations). In many instances these logics become performative<sup>9</sup> and as a result structure practice—from criteria for funding schemes to evaluation methods. Thus despite the range of activity in art-science there remains a predominance of projects that are justified in relationship to either; their role in innovation; or as a way of representing science to a public. In contrast to these two logics, of innovation and accountability, there are some examples of art-science projects that follow a logic which Barry and Born name as the “logic of ontology”.

<sup>8</sup> This is the basis of much of the work on Creative Industries and Innovation, see Bakhshi et al. (2010; 2011).

<sup>9</sup> Performative is used here in respect to concepts of performativity and practice, with origins in the work of Austin (1962). Similarly Pickering (2010) describes science as performative.



certain art-science initiatives are concerned less with making art or science accountable or innovative than with altering existing ways of thinking about the nature of art and science, as well as with transforming the relations between artists and scientists and their objects and publics. (Barry et al. 2008)

This focus on ontology and change is similar to notions of ontological design (Willis 2006) and Fry's (2009) redirective practice. This is an important concept in respect to art-science, and transdisciplinarity, as transdisciplinary projects very often involve a "redirection of the habitual, a change in the being of the practitioner" (Fry 2009, p. 20). This is a recognition of the ontological nature of transdisciplinary practices, and the ways practice is involved in self and world making. The work of Fry, a design theorist, shows that we are designed by, and design within, the designed world, and that our designs continue to design long after leaving the drawing board, studio or laboratory. In his studies of the practice of science Pickering presents a somewhat similar description of the material agency of the machines of science as a decentered posthumanism. Similarly Winograd and Flores (1986) discuss the ontological nature of design, showing how the design of a "new technology or systemic domain create new ways of being that previously did not exist and a framework for actions that would not have previously made sense" (Winograd and Flores 1987, p. 177). Ontological design(ing), Willis (2006) claims, is both a "hermeneutics of design [...] understood as a subject-decentered practice" as well a case for mindful intervention within this circular operation of design, which in the context of the contemporary crisis of crisis is necessarily political. This recognition of the political brings us back to Barry et al. (2008)—who suggests that one mode for interdisciplinary projects has a ground in Mouffe's political theory of agonism (2013), a subject developed in respect to practices in art and design by DiSalvo (2012). Many of the artists and designers discussed by DiSalvo in his work could be described a working broadly within art, science and technology, and as experimental. Here we see artists and creative works engaged in a form of critical dialogue, which is beyond that which is possible within commercial design or purely technically focused research.

## 5 Art Science and the Experimental?

What confers [art] with its perennial possibility of eclipse is its function of rupturing with forms and significations circulating trivially in the social field. [...] Art confers a function of sense and alterity to a subset of the perceived world. The consequence of this quasi-animistic speech effect of a work of art is that the subjectivity of the artist and the 'consumer' is reshaped. The work of art, for those who use it, is an activity of unframing, of rupturing sense, of baroque proliferation or extreme impoverishment, which leads to a recreation and a reinvention of the subject itself. (Guattari 1995, p. 130)

In addressing the subject of art and science it is always tempting to provide a handy definition, yet any such definitions are fraught as both art and science are



heterogeneous fields of practice, with their own contestations and deliberations about what constitutes art or science. As Wilson notes, the last century of Art history “has left the philosophy of art in turmoil”—making it “difficult to achieve consensus on a definition of art, the nature of the aesthetic experience, the relative place of communication and expression, or criteria for evaluation.” Over the same period science as a field has gone through a series of what Kuhn (1970) describes as paradigm shifts. The claims and assumptions of science have been critiqued and questioned by numerous authors, including Polyani (1964); Hacking (1983); Feyrabend (1985); Winner (1986)—foregrounding in many instances the social and human dimensions. As a result both within science, and in studies of science, there remains contestation regarding key questions of methodology, epistemology and ontology, which makes it difficult to resolve any shared consensus. More recently authors like Pickering (2010); Haraway (1998) and Lenoir (1998), have argue that scientific research produces highly situated knowledge and can be understood as cultural construct, rather than straight theory or facts. Thus Wilson (2002) comes to the conclusion that both art and science “make questionable truth claims and attempt to create privileged positions, but in reality participate in the system of symbols and narratives that shape the culture” (2002, p. 19).

1. Our apprehension of the world is active, not passive, and art displays an emergent apprehension.
2. Art is only incidentally and not essentially aesthetic. Art is concerned with every kind of value and not particularly with beauty.
3. Art interrogates the status quo; it is essentially, and not incidentally, radical.
4. Art is experimental action: it models possible forms of life and makes them available to public criticism. (Brook 1974)

For Brook (2012) experimental art is a form of “memetic innovation,” a view that draws our attention to the way experimental art operates within the social field. While Pickering (2010) describes science as an encounter where machines, instruments, facts, theory, human disciplines of practice and social relationships are intertwined.” If we are to appreciate art as social relation (Carter 2004), experimental art can be seen as a similar encounter—one that Brooks describes as emergent, radical and interrogating the status quo. Such practices for Guattari (1995, p. 130) involve a “rupturing of forms and significations circulating in the social field ... lead[ing] to a recreation and a reinvention of the subject itself” (1995, pp. 130–131). Thus experimental art is not an experiment conducted to produce singular truth, or falsify a hypothesis, as if operating in a world of scientific realism. Instead experimental art questions the assumptions of both art and science—which includes the logics of experimentation—through the way it explores the possible. This occurs in public, becoming part of a complex ecology of relationships—taking the form of a radical experiment.

Both science and art are emergent in nature, Pickering (2010) described science as an emergent practice occurring in “real-time”, while Brooks’ describes experimental art as involving an “emergent apprehension”. So it not surprising that

experiment and experience share similar etymological origins—both derived from the Latin ‘*experiens*’, meaning to “to try out”. The definitional difference here is that experiment is intransitive, while experience is direct. We experience the world first hand, yet experiment upon or on the world. The emergent, ‘real-time’ nature of science suggests that this distinction is not so clear, and foregrounds the experiential nature of experiment. In a similar way, Feyerabend suggests that when considered from a cultural point of view—we mistake the structures of Being with the way “Being reacts to human interference” (1996). From this perspective we can come to an understanding of experimental art as a form of experiment that is designed to explore the meaning and structures of Being, by creating artistic/ aesthetic social experiences, experiments in which the audience plays a direct role.

A further decomposing of *experiens* reveals the prefix *ex*, meaning “out of”, and the suffix *periri*, which refers to trial, peril, thus involving risk. It is this notion of risk that draws us to another similarity and difference between art and science. An experiment involves risk, without risk is it an experiment? Both artists and scientists take risks when they make commitments to their creative works, and hypothesis/ theories respectably. Both commit to an uncertainty, and once published, put themselves on the line publically for their work. As will be seen in the examples discussed, the risk of the experiment of art-science, is ever present but is transformed through the movement out of the research lab and into the public.

Art and science are full of contradictory theories, it is however easier to reconcile ambiguities within the arts, than science. Artists trade in metaphors, analogies, poetics, signs and symbols, all of which have no singular or fixed meanings, and in many instances the significance of a work lies in its ambiguity, or the complexity of multiple readings. Within science the most significant contradictions emerge from the view that science constructs the reality it studies. This is either through the very act of observation, for example in high-energy physics where particles of interest are created, as opposed to being found, within monumental experimental apparatus. Yet, as authors like Pickering, Freyabend and Ascot show, we do not need to turn to quantum mechanics to see these contradictions and tensions within science. Such philosophical debates may prove concerns within science, yet Ascot suggests it is artists who are “particularly responsive to the idea that nature is constructed” (2006, p. 9)—due to the fact they primarily deal with metaphor and other forms of ambiguity and uncertainty.

In science the experiment plays a pivotal role in theory generation (or falsification). Questions about the epistemological and ontological implications of experiments, and experimental apparatus, have been motivation for paradigm shifts over the history of modern science. Yet there prevails a view that theory is more important and separate from the messy embodied material real world in which experiments take place, and the tacit and practical knowledge that is integral to the success of any experiment. As such experiment is caught within a dichotomy—between theory (*theoria*) and practical skill (*techné*). This Feyerabend describes as a “conflict between a real but hidden world and a sham world that is accessible to humans” a conflict that he argues can be “found in all areas of human endeavor.”

Digital Da Vinci

Computers in the Arts and Sciences

Lee, N. (Ed.)

2014, XIX, 292 p. 137 illus., 107 illus. in color.,

Hardcover

ISBN: 978-1-4939-0964-3