The Art and Science of a Long-term Collaboration

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Abstract

In this paper we consider some aspects of the historical relationship between science and art, and look at some implications of these historical precedents for contemporary art-science collaborations. From our experience we identify some of the important elements of a successful collaboration, including: creativity and risk taking; the development of a common language; external endorsement in the form of funding and public recognition. We look at a number of practical considerations that face scientists and artists working together and then present a range of issues relating to our own collaborative projects. We conclude that creative collaborative partnerships open up a space in which individual artists and scientists can gain a new perspective on their own work and together can acquire new tools to reflect on some of the bigger issues that concern us all.

Biographies

Alexa Wright is a visual artist working with photography and digital media. She is a Senior Research Fellow and Lecturer at the Centre for Art, Research and Technology Education at the University of Westminster in London. Alexa has recently been awarded an AHRC/Arts Council Fellowship to work on a new project in the Centre for Auditory Research at University College London, where she has collaborated with Professor Alf Linney since 1998.

Alf Linney is a Professor of Medical Physics at the Centre for Auditory Research (CAR), University College. Over the past 25 years he has developed methods of applying computer graphics and augmented reality techniques to surgery. He had a long standing interest in the relationship between art and science and has exhibited his sculpture internationally.

The Art and Science of a Long-term Collaboration

Introduction

We - medical physicist Alf Linney and artist Alexa Wright - have been working together since 1998. We have already carried out two major research projects that have led to the creation of interactive installations, and are now working on a new collaborative project. We will briefly describe our work later in this paper. First, however, we will give some general background to the field and introduce some common issues relating to science/art collaborations.

Although the areas of human activity that we have come to identify separately as science and art each embrace diverse and wide-ranging interests, we believe that the two disciplines share an underlying will to enhance human understanding and to extend our experience of the world. A motivating factor at the heart of both art and science is a desire for the pleasure of understanding something new and of communicating this to others. At the highest level of both forms of endeavour we can see this creative impulse at its strongest. For example, in the 1930's Andre Breton founded the revolutionary Surrealist movement as a reaction against the art establishment, whilst Einstein's theory of relativity (1905) came out of a way of thinking that challenged the very foundations of Newtonian physics, and also informed the work of radical artists such as Marcel Duchamp.

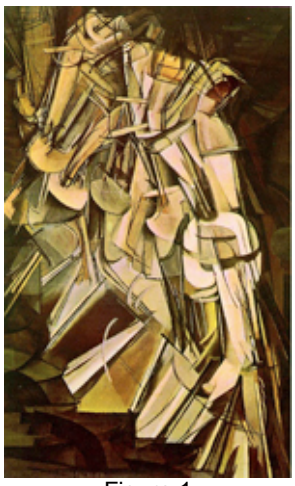

Figure 1

Since the Enlightenment, Western culture has seen a period of increasing specialisation in both the arts and the sciences, which

on the surface seems to have created a growing separation between the disciplines [1]. However, the relationship between art and science cannot be reduced to a binary division. There are, of course, numerous historical examples of discord between the two disciplines where boundaries are fiercely defended, but there are also many examples of correspondence and interdependence. The relationship between science and art is clearly inseparable from its broader context and is dependent on changing individual and collective social and cultural values. An early instance of the symbiotic relationship between art and science may be found in the guild system that emerged in the Middle Ages as an institution for the training and support of artists and artisans and within which, for example, chemists were grouped with painters. A contemporary example may be found in Marc Quinn's DNA portrait of leading geneticist Sir John Sulston, about which Sulston asks: "The portrait is the result of a standard laboratory procedure, transposed into the setting of the Gallery. Does this change of viewpoint alter our perception of the object, and of the techniques that gave rise to it?" [2]

Figure 2

Although in certain contexts we may feel that artistic and scientific enquiry are once again recognized as interrelated aspects of a unified quest to understand the world, many of the structures that were created around both art and science during the nineteenth and twentieth centuries remain and still work to obscure this commonality. According to Lorraine Daston: '[The] early nineteenth-century confrontation of individualistic, brashly subjective art with collective, staunchly objective science was not simply the collision of some timeless faith in the imagination with an equally timeless faith in facts. Rather, it signalled a mutation in the meanings both of imagination and of facts that still shapes

the moral economy of science' [3]. Daston locates a historical split between imagination and fact that continues to influence contemporary attitudes. In our experience, science and art are still stereotypically thought to be at opposite ends of the intellectual spectrum. In many contexts there remains a legacy of blind faith in scientific fact, coupled with romantic notions about the subjective and imaginative qualities of art. The modern roots of this perceived opposition may be found within the curricula of many educational institutions, where the expectation - or even the possibility - of a dialogue between artists and scientists is denied at an early and influential stage of a student's development.

Although it may be true that, of necessity, science tends more towards the objective and analytical and art tends more towards the subjective, both artists and scientists must actually move between concept and experience, and therefore between the subjective and the objective. This correspondence between the two disciplines is illustrated by the fact that artists can sometimes reach the same conclusions as scientists, even though these conclusions may be arrived at by different means and for a different purpose. For example, at the beginning of the nineteenth century, Goethe noticed that the nature of colour is influenced by the viewer - an observation that, one hundred and fifty years later, was also made by scientists [4].

Further to the more obvious disciplinary separation, there are other cultural differences that cut across the arts and the sciences. For example, there is clearly a divide between practitioners who remain secure in the territory of their own expertise and for whom moving outside those boundaries to experiment with ideas from other disciplines is too challenging, and those for whom interdisciplinarity is more natural. Although most readers of this text would identify with the latter group, it is important that we recognise that the most productive form of behaviour is not always expansive – for some artists and some scientists a narrow focus is most appropriate. Within the affiliation between art and science there is also a spectrum of possible relationships, some of which may prove to be more productive than others. Whilst many contemporary scientists are interested in the decorative or evocative qualities of art, and in using art to illustrate their work or to render it publicly accessible, there are also those who feel constrained by their allotted discipline and feel that an artist could bring a new understanding to the ideas and processes they are working with. For artists, science can provide interesting new subject matter, but it can also offer access to new tools, processes and skills.

Some Elements of a Successful Collaboration

Based on our experience of working collaboratively, we will briefly comment on what we believe to be some of the essential elements of a successful science-art collaboration. Although these elements are inter-related, we will divide them into three broad areas:

- Creativity, risk taking and persistence
- Discussion and the development of a common language
- External endorsement in the form of funding and recognition

As we have already suggested, creativity is an underlying force at the core of both scientific and artistic endeavour. Equally, any significant development in art-science collaboration is led by the desire to create something new. However, interdisciplinary practice introduces an element of risk when it disturbs the established traditions of any one discipline. Participants in innovative collaborations must, therefore, be aware of the possible effects of ideas and outcomes that transcend the historically assumed boundaries between art and science. At this level creativity threatens the accepted order of things and so, since both the form and content of science-art collaborations are likely to be perceived as alien within either culture, both artists and scientists must be prepared for adverse reactions from their peers. Another, and perhaps greater, element of risk arises when working outside established canons in that the problems presented may be unfamiliar and the solutions unclear. In this case there is a feeling that the responsibility for success or failure of a project lies with the individual artist and scientist. This sense of responsibility coupled with lack of peer support demands a high level of persistence and resolve.

One clear necessity for successful collaboration is that of developing a common language. We do not suggest that the artist should necessarily understand scientific terminology, or that the scientist should take on the jargon of the art world, but rather that a conceptual understanding is developed between the partners. Expressed in terms of goals and concepts, the collaborators' mutual understanding of what they are trying to express does not necessarily depend upon the words used, but rather on a shared understanding of the meaning and intention, or purpose, of the work. As in any relationship, a failure of this understanding will not lead to a successful outcome. Our own collaborative projects have involved long periods of discussion and reflection, during which time a common language has

automatically been negotiated. Within this space ideas are productively developed and a mutual respect is fostered.

Whilst we believe that collaborative projects must be founded on a shared interest in developing ideas there are, of course, other factors that contribute to their success. A degree of external approval and of public understanding is necessary for a collaboration to survive in the long term. At a basic level approval is expressed in the form of public funding, which not only enables work to be carried out, but also makes a project seem 'worthwhile'. In the eyes of interested bodies such as the funding agencies there is a perception that, in talking to one another, each discipline is likely to moderate its language accordingly, and as a result become more publicly accessible. Although the issue of public accessibility is not always easy to consider in the production phase of a collaboration, it is also true that without an external support structure and some level of public understanding, art-science partnerships struggle for credibility in relation to their individual disciplines, and struggle to find a context for their outcomes.

Siân Ede, Arts Director at the Gulbenkian Foundation in London, has suggested that artists have always enjoyed testing the capabilities of new materials and technologies, been alert to assessing how new scientific discoveries can alter the vision we have of ourselves, and asked awkward questions about the moral and ethical consequences of science [5]. However, Ede identifies the mutual desire to collaborate to make new work together that reflects the interests of both parties, as a relatively new phenomenon. It is difficult to determine whether the rapid increase in the number of artists and scientists seeking to work collaboratively over the past decade or so is due to the increased availability of funding from bodies such as (in the UK) the Wellcome Trust, the Gulbenkian Foundation, NESTA and others, or whether the increase in available funding is a response to the growing interest in collaboration on the part of artists and scientists. In any case, the availability of funding is certainly contributing to the recognition of art-science collaboration as a viable domain.

Our Collaboration - A Case Study

Our own collaboration is one where the boundaries between art and science have, to a large extent, dissolved - both in terms of the division of labour and of the ideas we are exploring. Our ideas are conceived beyond disciplinary boundaries and have relevance in both art and science contexts. Arising out of conversations

about topics that mutually interest us, ideas for the outcomes of our projects are initially formulated by Alexa as artworks. However, these ideas have also led to a range of broader outcomes with applications in science as well as art. The success of this collaboration, which started in 1998, has depended upon several factors. These include: a common set of research interests; a working method that relies on constant dialogue; a shared sense of curiosity, and the ability to persist in the face of seemingly impossible challenges.

The first of our collaborative projects, *Face Value*, resulted in an interactive installation first shown at the *Exploratorium* in San Francisco in 2000. Referencing the pseudo-science of physiognomy, this work relies on our ability to mathematically measure the static features of the human face. In the installation the user sees a computer screen displaying a life-size image of an average face, derived from sixty different individuals. As he or she sits in front of this screen, the user's own face appears superimposed over the average.

Figure 3

An image of the user's face is captured by pushing a button. The computer then calculates differences between the facial dimensions of the user and those of the average face. An individual 'character reading' is printed out based on these measurements. Whilst the machine is invested with the ability to divine character, if someone smiles or turns sideways whilst interacting with it, he or she will inevitably receive a distorted reading. Whilst initially seen as a problem, this kind of technological fallibility has now become integral to our work. This installation is not designed to create an 'accurate' character assessment, or to assert the validity of any physiognomic system, but rather to open up a discursive space where people can

consider the unconscious mechanisms we use to read character from one another's appearance.

The *Face Value* project was developed in the Department of Medical Physics at UCL over a two-year period. Research towards the installation led us to new ideas about aesthetics in surgery and led to the development of methods for creating an average face that may be used to compare the average effects of surgery on different clinical groups.

Initially Alexa was treated with suspicion by many of Alf's scientific colleagues, who believed that we were proposing impossible tasks and that the process of art-production was irrelevant to them. Gradually, however, as some of the proposed tasks *were* realised and Alexa became a familiar fixture within the department there was a greater level of acceptance. The project had the effect of broadening perspectives and fostering new dialogue across the laboratory. We found that scientists' preconceptions about art, usually formed by their educational experiences, were changed by the experience of seeing the outcome of this project.

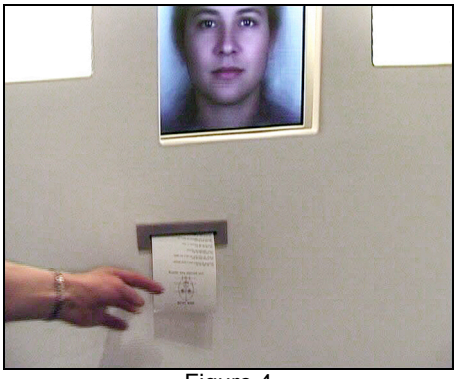

Figure 4

Following *Face Value,* our conversations led us to take on the greater challenge of looking at the dynamic features of the face. Our subsequent project, *Alter Ego,* which started in 2000*,* investigates the familiar sense of being outside oneself and plays with the experience of a loss of control over an aspect of the self. [6]

Using a computer to produce a semi-autonomous replica of the person sitting in front of it, the installation invites individuals to question the various facets of their own identity. What appears to be a large, dark mirror in frame hangs on a black wall. A stool with a curved black screen behind it is placed one and a half metres in front of this 'mirror'. As the system

detects a face in its field of vision, the individual user is invited to sit still on the stool with a blank expression on his or her face for some seconds. The computer captures images of the face via a webcam located in the 'mirror'. Using data gathered from these captured images our system transforms a stored 3D model to appear as the face of the user. This forms his or her 'reflection'. After about thirty seconds this reflection begins to react to, rather than mirror, the user's facial expressions. For example, if the user smiles the virtual face, or 'alter ego', may look surprised or angry, or may smile back. The installation is fully automatic, and the interface 'intuitive'. The screen literally takes the place of a mirror, but also extends the experience of looking into the mirror. *Alter Ego* creates a series of gaps between the user's mental self image and his or her approximated self-image in the mirror; between the actual facial gestures performed by the user and their, slightly delayed, generic echo on the screen.

Figure 5

Alter Ego is a much more ambitious research project than *Face Value* and, although it has been exhibited several times, remains unfinished. The installation is displayed within the department at UCL, where it has become part of institute's promotional activities towards science funding, and is afforded some degree of respect within the scientific establishment. Although this is clearly a beneficial relationship, an uncomfortable question remains: what is the appropriate place for showing science-art collaborative practice?

Whilst it is interesting that our work has been identified as potentially useful in various scientific contexts [7], it is validated within the scientific community primarily for its potential usevalue rather than as an artistic or philosophical statement in its own right.

Figure 6

The scale of our projects and level of funding we are able to secure necessitates that most of the work is done by us. For long periods Alexa has become a scientific researcher. Whilst this practice is tedious, it is also beneficial to the collaborative partnership when the artist can learn about science, contribute to the extension of scientific language and processes and help develop new scientific methods. However, because our work relies on new technologies, we are also dependent on a third party. A major problem we have encountered during our collaborations is that of finding technologists or technicians willing to move outside their normal work experience to produce some of the elements required to realize our work. New Technologies extend human perception, offering artists and scientists new tools with which to investigate the world, but in our experience these technologies also create a hurdle for the realization and dissemination of ideas. This problem, which has been addressed by Edmunds et al. in respect of the COSTART project, where a laboratory was set up to provide technological expertise for artists, remains a complex one [8]. Whilst from the point of view of the artist, a high degree of support initially seems to offer an ideal framework for the production of work, there is a danger that this could constrain the imagination of the artist. On the other hand, if the relevant technical expertise is not available, it is easy to become frustrated with technological limitations when proposing a project that relies on technologies that do not yet exist. Although technologies do act to facilitate our work, and their limitations have indeed become part of its subject matter, we also find that we are constantly struggling for a means to extend available technologies to fit our ideas. However, the insufficiency of existing systems relating to the *Alter Ego* project has also had a positive effect, in that it led Alf to explore a new and effective means of classifying facial expressions.

We are currently researching towards *The Listening Room*, an interactive audio installation where (a small number of) audience members are invited to walk into an empty room. The room will automatically track its occupants and, using directional sound sources, will pose questions to individual audience members. Using keywords to interpret what has been said in reply, the room will then pursue a dialogue with an individual audience member that can be heard only at the specific location he or she occupies. The idea for this work was, in part, born out of Alf's relocation within the University to the Centre for Auditory Research (CAR), where projects necessarily have an audio component. It was also informed by the experience of making *Alter Ego* and Alexa's fascination with creating a porous and unencumbered interface between the real and the virtual. As with our previous projects, we will adopt a procedural approach. The outcome of the project will depend on our findings during the research period and on the extent to which we can extend the limitations of existing technologies. In this project, where art is again driving science to develop, we hope to draw upon the expertise of other scientists working within the CAR and beyond to help us explore new aspects of the human/machine relationship.

Conclusion

Whilst we believe that the advancement of a common language will help to enable successful collaboration between artists and scientists, we also recognise that, at some levels, there are still fundamental differences between the two disciplines. Generally it seems to be true to say that art is interested in asking questions, is comfortable with uncertainty, and is not necessarily interested in finding answers; whereas much of science *is* looking for answers, and is - in some cases misguidedly - seeking certainty. Whilst science is, for the most part, focused on altering our physical relationship with the natural world, art is orientated more towards a philosophical and emotional understanding of that relationship. However, at the highest level both disciplines necessitate acts of imagination in order to make new discoveries, whether these discoveries are philosophical or utilitarian.
The most significant scientific discoveries have been made when the rules of an established system are broken. It is therefore probable that scientists who are not constrained by the usual rules of scientific ways of thinking are more likely to come up with new ideas. One of the potential benefits for a scientist working in collaboration with an artist, then, is the expectation that he or she will be challenged to think creatively, with more freedom of thought. Although we believe that significant scientific development depends on the overturning of established ideas, there are clearly

still many people for whom science remains a system of indisputable 'truths'. By contrast, art can be perceived as an illustration or fetishization of these higher truths, with little or no power of critique. There is clearly no single model for a successful art-science relationship, but as more artists and scientists learn to talk to one another we will inevitably gain a richer understanding of one another's practice and start to diminish these stereotypes. Creative collaborative partnerships open up a broader space in which individual artists and scientists can gain a new perspective on their own work and together can acquire new tools to reflect on some of the bigger issues that concern us all.

References and Notes

1 Berlin, Isiah *The Age of Enlightenment :the Eighteenth-Century Philosophers* Oxford University Press, 1979.
2 Sir John Sulston, National Portrait Gallery press release 18/9/2001 at: http://www.npg.org.uk/live/prelgeno.asp
3 Daston, Lorraine Fear and Loathing of the Imagination in Science *Daedalus* Fall 2005 pp16-30.
4 Goethe, Johann Wolfgang *Theory of Colours* (1810) translated from the German with notes, C. L. Eastlake. London, 1840.
5 Ede, Siân *Strange and Charmed: Science and the Contemporary Visual Arts* London, Calouste Gulbenkian Foundation, 2000.
6 Further documentation may be found at: http://www.alteregoinstallation.co.uk
7 Following a presentation of *Alter Ego* on Danish Radio [http://www.dr.dk/Videnskab/Harddisken/Programmer/2004/5/alter ego.htm] we were approached by psychiatrist, Professor Josef Parnas who expressed a belief that our project "has a lot of relevance for research concerning disorders in self-awareness". Parnas proposed a collaboration in which a version of *Alter Ego* could be used with patients with schizophrenia spectrum disorders. [Parnas, Josef, 'Psychopathology', *Danish National Research Foundation: Center for* Subjectivity *Research*, http://www.cfs.ku.dk/content_home.htm]. Scientists at Cambridge University Autism Research Centre have suggested that *Alter Ego* could offer a way of coaching people with autism or Asperger's in the art of interpreting and responding to facial expressions [http://www.autismresearchcentre.com/arc/].
8 Edmonds, Ernest E, Alastair Weakley, Linda Candy, Mark Fell, Roger Knott, Sandra Pauletto The Studio as Laboratory: Combining Creative Practice and Digital Technology Research *International Journal of Human-Computer Studies* 63, 2005 pp 452-481.

Illustrations

1 *Nude Descending a Staircase* Marcel Duchamp 1912.
2 *Portrait of Sir John Sulston* Marc Quinn 2001.
3 *Face Value* installation shot, Revealing Bodies exhibition, *Exploratorium,* San Francisco USA 2000.
4 *Face Value* detail.
5 *Alter Ego* Installation shot, Magna, Rotherham UK 2004.
6 *Alter Ego* Work in Progress exhibition, Kettle's Yard Gallery, Cambridge UK 2002.