New Constructs in Art

Malevich’s insight into science and systems\(^1\) came well before the advent of computers, but at a time when mathematical logicians were developing theories that proved to be very important for the invention of the computer\(^2\). This work on mathematical logic was investigating particular kinds of system, known as ‘Formal Systems’. These are sets of precise rules that apply to finite collections of objects rather like the rules of chess and the chess pieces. Such systems are fundamental in computer programming. A computer is basically a logical machine that manipulates systems of symbols\(^3\). The symbols have formal rules that determine how they relate to one another, rather as the pieces on a chessboard can be placed in very many different arrangements, but only ones in which certain rules are obeyed. When a computer manipulates such a system, it automatically ‘moves the pieces’, keeping within the rules, and searches for a result, such as checkmate. Another example of such a system is a collection of shapes with defined correspondences between them, such as a Lego\(^\text{TM}\) set\(^4\). In effect, the computer can re-arrange the pieces in any way, but only so that the rules, that determine how they fit, are followed.

The most significant property of the computer is that it can perform any task that can be defined for any formal system to do. It is a General Purpose Logical Machine. In one sense a computer can do anything. However, that statement begs the question of how we define whatever it is we want the computer to do. The computer can do anything provided that we can define precisely how it should be done\(^5\). Writing those definitions is the art of computer programming and it is well understood that programming, at least in a non-trivial way, is quite difficult. For the artist therefore, as for anyone else, using the computer is quite a challenge. However, it provides a unique opportunity to express structures and relationships in one, two and three dimensions as well as in time and between different media.

The outputs that a computer generates, be they texts, sounds, three-dimensional objects, drawings or movements, are generated by a mapping from a set of internal symbols to a set of physical entities such as marks,
sounds or actions. The internal symbols, in turn, are determined by the operation of a formal system. For all its ability to calculate quickly or put images on screens or paper, it is the operation of formal systems that is at the core of what is unique about the computer.

For artists with an interest in the structure of their work and in systems, the computer was a natural and irresistible medium to explore. Whilst a role for logical systems in art is possible and interesting, the concrete realization of formal systems in logical machines, i.e. computers brought new possibilities into play. The formal systems became dynamic as, in effect; they became expressed in computer programs. Whereas before formal systems were abstract and manipulated by human action, now a machine existed that could perform such manipulation automatically and unimaginably quickly. It became possible, for example, to build machines that could play chess. This meant that an important step forward, from Malevich’s concept of systems in art, was taken by the artists who adopted programming in the 1960s. Each of them approached the subject from his or her personal point of view and not all of them would use the term system in relation to their art, but if they programmed a computer they certainly used a formal system in practice. By developing new formal systems in our work we have been developing new constructs in art.

This discussion is primarily concerned with inventing new constructs for art practice and new structures to underpin artworks. The notion of structure, as used here, is of a recoverable system in the sense that it is in theory possible to look at the final object and work out the structures that led to its creation. Whether anyone ever would, of-course, is another matter. It is theoretically possible but practical often just not a reasonable thing to try to do. So an artwork formed in the ways discussed above has a clear structure and, being clearly predictable, is highly constrained in what it does. That, nevertheless, does not mean that it is boring in the sense of the audience or participants knowing actually what is going to happen next or how it works. In the example of video constructs, the explicitly determined part is the generative method defined in the program. However, the whole point is the actual output: the generation of the visual sequence, the images, rather than the program.
In one case above, the concept is to create a communications network as an artwork in which the participants become engaged in a process where they try to impose a structure, or order, on the pattern of events that they experience. In video constructs, the underlying logic is used to provide a structure in time, which is the basis of the generation of the works. In the correspondences, an underlying structure is used to unify vision and sound. For each ‘instrument’ the appropriate structural elements are mapped into given sounds or images.

The new constructs in art that have been discussed could only have come about as a result of the invention of the computer and the development of the understanding of computation that preceded it. Remarkably, the direction that artists such as Malevich were going in during the early part of the 20th Century pointed directly towards these, at that time, unimaginable new directions. The introduction of the computer into art practice has transformed both that practice and the forms of the resulting artworks. It has certainly revolutionised my practice both conceptually and technically.

Exploring correspondences between the audio and the visual elements of my art continues to be important. In addition, my practice is increasingly concerned with interaction, even more than it was thirty five years ago and as presented at the CG70 Conference at Brunel University. A newer explicit concern is that of location: making art systems for a variety of public and private spaces.

As a result of the work of recent decades issues about the nature and effect of interaction have been clarified. They point to new directions and new art constructs. To take a key example, it is important that the audience recognises that the art system is responding to them and so an immediate recognisable interactive reaction is required. However, simple reactive systems are not very rewarding and certainly do not lead to sustained audience engagement. Hence another dimension is required. I call this response. My current work is exploring long-term responsiveness to the audience by the art system. These audio-visual works instantly react to the presence of the audience, and are therefore interactive in the direct sense,
but they also develop changing behaviours over time as a result of their interchanges with active audiences.

By their very nature, interactive works are appropriate in locations outside the traditional art gallery. I am particularly concerned with the possibilities for them in public spaces, including galleries, where the audience becomes active through its chance, or unconstrained, encounter with the work. I do not make use of headsets, special gloves or any other such device as these require an organised entry into the space of the artwork. The use of such devices avoids one of the issues of interaction in art systems: forming audience engagement in the first place.

The concerns of my current practice require experimental studio spaces in which to work and, most particularly, experimental locations in public spaces. Research is a significant part of this art practice. To this end, I have extended my current studios in Sydney by adding an experimental interactive space, Beta_Space, in the Powerhouse Museum Sydney. This is one step on the road to understanding the implications of public locations for interactive art.

The stimulus of the computer for the invention of new constructs in art is far from over. In fact we are only now advanced enough in the technology to really begin this exploration of, as Cézanne put it, the “language and a logic of art” that digital technology has enabled.
NOTES

2 Studies in mathematical logic and the philosophy of mathematics were fundamental in building the theoretical foundations of modern computers. The logicians were concerned with various philosophical problems concerning the manipulation of symbols that lay at the heart of understanding and justifying mathematics. Explaining this requires a book length discussion as given, for example, by F. P. Ramsey, in The Foundations of Mathematics and Other Logical Essays. Littlefield Adams & Co., 1960.
3 From the point of view of the logical foundations of computing, the computer is a machine that automates symbol manipulation. When it performs arithmetic, for example, it actually does the sums by moving symbols around according to the rules of arithmetic.
4 Lego blocks can fit together in very many ways, but the way they fit is, in fact, highly constrained. Relationships between them are determined by their interlocking shapes. The constrained freedom of construction offered by Lego is precisely its appeal. There are endless possibilities but all of those possibilities must obey a set of pre-determined rules, just like a computer system.
5 Alan Turing, investigating the fundamentals and limits of computation, showed how, in theory, a general purpose machine could be constructed. In fact he was exploring the very meaning of computation by defining it in terms of such a machine. The work was published in On Computable Numbers, with an Application to the Entscheidungsproblem ,Proceedings of the London Mathematical Society (2), 42, 1937 pp 230-265. In his specific technical sense, the computer is a general purpose machine. It can do anything. However, it can actually do anything that someone can specify, or program it to do. Of-course, programming the computer to do anything we want is not only hard it is, in certain cases, impossible.
6 In simple terms, any mechanical output from the computer is produced because some internal symbols have taken values that cause an electrical switch to be changed. The changed electrical value is then used as the start of a sequence of electrical, mechanical and even, possibly, chemical actions that results in the physical event. Within the computer itself, the physical behaviour is seen purely in symbolic terms.
7 English artists, such as those in the Systems Group (referred to in relation to Bann’s article above), often used the term ‘recoverable’ when discussing the systems used to generate their abstract works. The basic concept was that the work itself
contained sufficient information for an astute analyst to be able to work out what system the artist used. For example, if a work consisted of a sequence of lines each shorter than the previous one it could be that measuring them would reveal that the length of each was the square route of the length of the previous one. Typically, these recoverable systems were only theoretically recoverable because the labour required to unpick them was too great for it to be done in practice. What mattered, however, was the notion that the work was recoverable in principle if not in practice.  


The Creativity and Cognition Studios (CCS), in which we conduct multi-disciplinary research into art practice and digital technology: http://www.creativityandcognition.com

To quote from the CCS web site, “beta_space: art> technology> experiment> discovery The Powerhouse Museum and Creativity and Cognition Studios (CCS), University of Technology, Sydney are collaborating to create beta_space an experimental environment where the public can engage with the latest research in art and technology. beta_space will show interactive artworks in development by CCS researchers and collaborators. The works may be at different stages, from early prototype to end product. In all cases engagement with the public will provide critical information for further iterations of the art work or of the research. The name beta refers to a new piece of software or hardware that needs testing and feedback from its users to help the project team to eliminate design and engineering errors. beta_space will give visitors to the Powerhouse Museum the chance to experience collaboration between art and technology. Information displays will contextualize the role of CCS and beta_space in this international field. beta_space will be a working environment a laboratory - yielding valuable research outcomes. It will give people the opportunity to be creatively involved in the development of new forms of artistic expression, and it will give an insight into the creative process of artists and technologists.”