

Roche Court Seminars

Art & Maths

Educational Friends of Roche Court

Art and Maths
An Exploratory Seminar

Saturday 11 October 2003

Dr. Ulrich Grevsmühl

with

Michael Kidner

Richard Long

Jo Niemeyer

Peter Randall-Page

Gary Woodley

Art and Mathematics - - an exploratory seminar

A summary by Dr. Ulrich Grevsmühl

***A mathematician, like a painter or a poet, is a maker of patterns.
If his patterns are more permanent than theirs, it is because they are made
with ideas...***

***(His) patterns, like the painter's or the poet's must be beautiful; the ideas,
like the colours or the words, must fit together in a harmonious way.
Beauty is the first test; there is no permanent place in the world for ugly
mathematics.***

Godfrey Harold HARDY (English Mathematician 1877-1947)

In October 2004 the New Art Centre organized a one-day interdisciplinary seminar on Art and Mathematics as part of its educational programme. Hosted in the superb surrounding of the Roche Court estate, it was an occasion which brought together 5 out-standing and world-famous artists and a mathematician in an inspiring and unforgettable event.

Dr. Ulrich Grevsmühl who is a mathematics educator and physicist at the University of Education Freiburg in Germany had devised the day and led the audience through the stimulating discussions, workshops and activities which revolved around the central theme: measure and measurements.

The morning sessions started off with the Golden Section and some of its applications. Grevsmühl gave an introduction to the subject and explained how the Golden Section and the Golden Angle is employed in the works of Jo Niemeyer, Michael Kidner and Peter Randall-Page. The afternoon sessions continued with the works of Richard Long and Gary Woodley and dealt with the interrelation of their works to measure and measurements.

The works of art, and in particular those of concrete and constructivist art, are of special interest for the teaching and learning of mathematics because of their mathematical, perceptual and conceptional implications.

Many of the works may be used as starting points for mathematical investigations and problem solving activities and offer the opportunity to experience art from the rational side. More than that mathematical relationships can be visualized much more directly and dynamically via the visual channel. In close cooperation with many artists in Europe and overseas Ulrich Grevsmühl has collected a large number of mathematical problems based on works of art and has done several publications on the interrelation of Mathematics and Modern Art since 1986.

The German artist **Jo Niemeyer** has been working in constructive-concrete art since 1970 and in land-art since 1988. At Roche Court he, with the assistance of his wife Tuula, created the new installation **2003**, a series of reflecting square plates which invited the spectator to a journey around the earth in just 20 steps. Taking the Golden Section as a means to measure Niemeyer's idea was to divide the circumference of the earth by the Golden Section and to repeat this process for each of the subsequently generated segments. For the mathematical formulation of the problem one has to take into account that every route around the earth is a natural fractal. Therefore the mathematical problem had to be formulated in terms of angles. Applying the golden section to the full circle yields the (minor) Golden Angle $\varnothing = 137.5^\circ$. Repeated application of the golden section to each newly generated minor through the process of division provides the increasing elements of the minors series in degrees.

For the work of art only the proportions between the distances are essential in order to understand the laws of formation. Niemeyer says: ***There is no measure - only the proportion exists.***

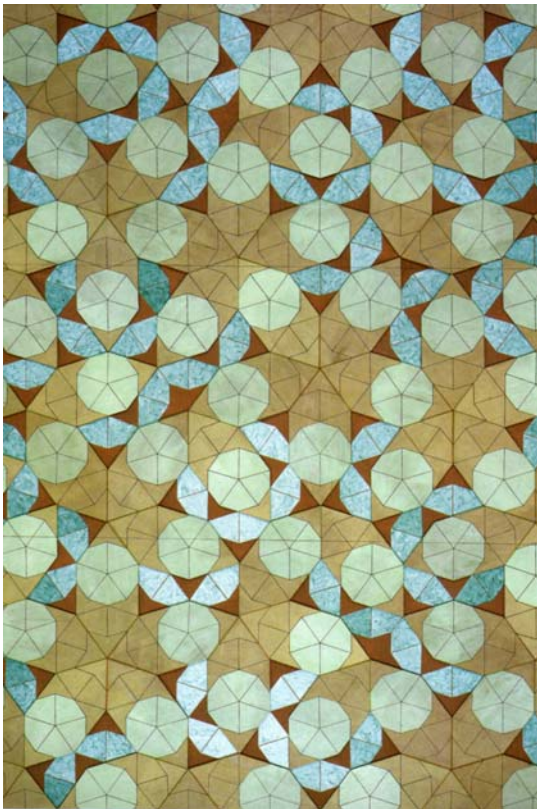
At Roche Court Niemeyer installed the first 8 steps over a distance of 147 meters where his installation amazed by its simplicity, harmony and beauty. Videos and computer simulations extended the series to the boundaries of the earth and indeed to macro and micro cosmos. In the workshop the participants were involved in several applications of the Golden Section like the making of an icosahedron by three intersecting Golden Rectangles.



Applications of the Golden Section to tilings and tessellations were dealt with in the workshop with **Michael Kidner**. Kidner employs the systematic approach, the constructive investigation both for creating and developing new ideas and making his works more comprehensible. His vast areas of work range from drawings and paintings to sculpture and installations combining the elements of rationality and feeling, order and beauty. He states: ***Mathematics is for me a word which suggests an attitude of mind rather than a skill - it offers a reference to my work which I find presently more acceptable than any alternative. Such an attitude allows me the freedom to organize and relate my colours and forms as abstract units but withholds the licence to do anything whatsoever that I choose.***

In some of his more recent works Kidner has used the so-called Penrose prototiles as the mathematical basis for his drawings and paintings. These works are indeed inspired by one of the most remarkable discoveries in the theory of tiling which has taken place during the last 30 years. It concerns the existence of sets of prototiles which admit infinitely many aperiodic tilings of the plane. In the early seventies the mathematician Roger Penrose at Oxford discovered three sets of aperiodic prototiles.

In the workshop the participants engaged in trying out various Penrose tilings. In two beautifully spoken and inspiring talks Michael Kidner outlined the artistic impetus and implications of his works. Using the patterns as a vehicle for his feelings he said: ***I have a feeling about organization and chaos. Organization requires energy, chaos is no energy, in other words it is the story of life and death.*** His current interest is in deconstructing the pattern by the use of different colours and thus creating chaos.

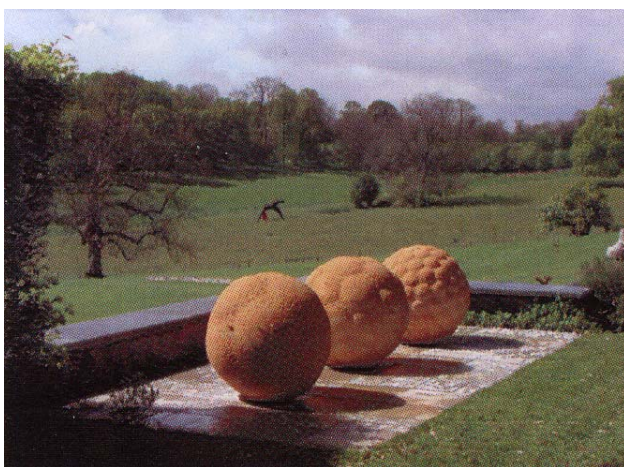




Phyllotaxis is the teaching of the arrangement of leaves in the plant kingdom. It provides impressive examples for the occurrence of rational as well as irrational proportions. An application of the Golden Angle and of the Fibonacci numbers can be found in the spiral principle of arrangement of leaves. In many of his works **Peter Randall-Page** investigates the structures of organic growth and the patterns that occur in living nature. In his superb talk he gave an insight into the development of his work while the participants enjoyed analyzing various forms of leaf arrangements.



For Randall-Page geometry is the theme in nature's variations. He says: ***Over the years my journey has been one from looking directly at objects in nature to actually trying to get a sense of what dynamics are at work that produce the things nature produces. ... In the real world you never see the underlying geometry in its absolutely perfect state, it is always adapted to local conditions.*** Quoting an Indian philosopher Randall-Page formulates his aim in the following way: ***Art should be ideal in the mathematical sense, like nature, not in appearance but in operation.***



For him nature reveals a dynamic tension, a tendency to order and a tendency to disorder or chaos. Talking about his work he described the problems of mapping the surface of a the given, random boulder with a given, perfect geometrical structure and its implications to the geometry employed. He also discussed some of the technical and mathematical procedures that arise in the process of carving the sculptures and in projecting the genetic helix onto pieces of stone.

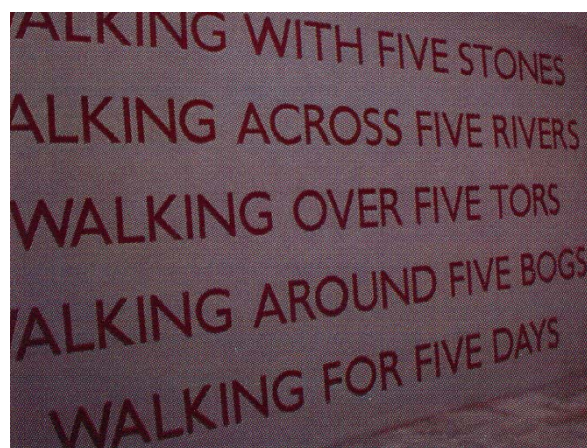
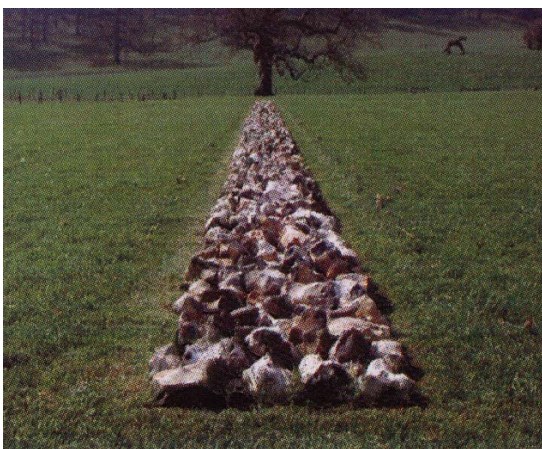
It was a rare opportunity for an audience to hear **Richard Long** speak about his work. In his talk Long gave a survey of his development as an artist. It was accompanied by more than 100 images. No wonder that the audience enjoyed the interaction with the artist and in particular the younger ones felt that they could ask all the questions they always wanted to.

A good work is the right thing in the right place at the right time. A crossing place. These words by Long apply well to his works of art which reveal a great affinity to landscape, to nature and particularly to walking in the landscape. His work uses measurement, ratio, relationships and symmetries. Fundamental to his art are his walks. Undertaken in many parts of the world, they form the link between the landscape and his outdoor or indoor sculptures, his photographs and map drawings. Very often his walks are accompanied and expressed in form of text works. Long says: ***By way of walking the world is a means of measuring the world.***

Long gave various examples of the different types of walks and how he uses measurement and number. Often his measures are not necessarily standard measures like miles or kilometers. In fact, in his works there is an interplay of things that can be measured and things that are immeasurable. Long says: ***I like to use the symmetry of pattern between time, places and time, between distance and time, between stones and distances, between time and stones.***

When asked if there is a message in his works Long denied this. But then he continued: ***One can make art anywhere in the world, in great solitude, in places of great wilderness, in places of inaccessibility, one doesn't have to make it in a studio or choose an art gallery. ...This is one of the messages of my work.***

And asked if he would make a work of art that no one would see, Long added: ***The whole idea of making art is to show it to someone else. Part of the chemistry of art is communication. But communication can be done in many different ways. Only the forms of communication vary.***

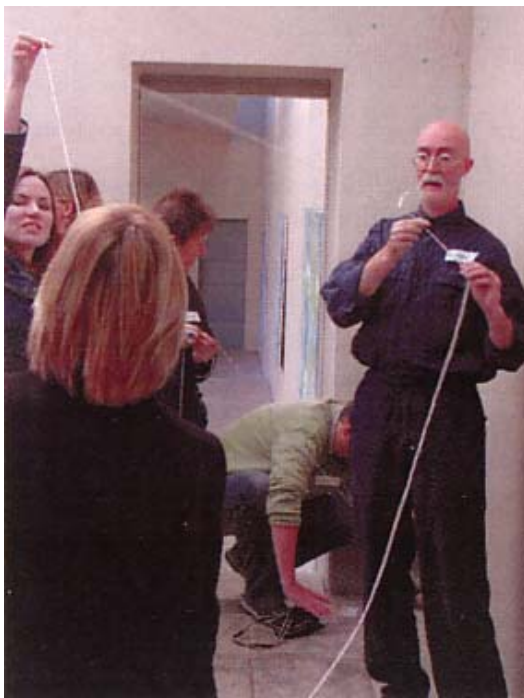




There is no doubt: The *trade mark* of the constructivist **Gary Woodley** are his *impingements*. Woodley is a constructivist who has previously been concerned with various aspects of Euclidean space, of Hyperbolic space and of topological space. He takes a strong interest in mathematical shapes and surfaces and in methods of projecting them from one space to another.



Carrying out experiments with soap films and geometrical forms and figures Woodley became fascinated by the immaterial of geometrical concepts. An important theme which runs throughout his impingement works is therefore the visualization of intersections of ideal solids, such as spheres and ellipsoids, with the physical reality of an interior or exterior environment which he describes as *intersections of material with immaterial*. Often his works are large-scale 3-D drawings with tape and electro-luminescent strips or just soft crayon which are performed in more or less empty rooms or outdoor sites. He says: *I like the feeling that the work is really the trace of something that has been removed. The geometry that is passing, slipping through.*



Woodley has developed his own methods of drawing and his own drawing tools for carrying out his sculptural constructions. In his earlier works he designed a pointing jig with flexible arms which enables him to draw regular curves, such as circles and ellipses, onto environmental surfaces and other irregular boundaries, very often with the use of a laser beam. Recently he has employed the computer for 3-D scanning of the environment (a whole building or part of it) and 3-D modeling enabling him for the first time to use very complex mathematical shapes and surfaces, like the Enneper surface, with which he had been fascinated for a long time but which were technically not possible before.

The audience were fascinated by the various activities with minimal surfaces of the soap film geometry and enjoyed his projective experiments in the Orangery at Roche Court.

Biography

Dr. Ulrich Grevsmühl read Physics and Mathematics at the Universities of Stuttgart and Liverpool. He was awarded a Florey European scholarship by The Queen's College Oxford and did his doctorate in Theoretical Atomic Physics at the University of Oxford in 1976. Today he is working as a Senior Lecturer of Mathematics at the University of Education Freiburg in Germany. He has a strong interest in interdisciplinary research. In cooperation with several artists has done many publications and seminars on the interrelation of Mathematics and Modern Art.

