SYMBOLIC SCULPTURE

The 1988–1990 exhibitions of my Symbolic Sculptures seemed to create a wide interest amongst scientists and mathematicians! The first show was in 1988 of three maquettes at the Royal Institution at a discourse by Sir Michael Atiyah on 'Knots and Physics'. Arising out of this, Ronnie Brown suggested a sculpture exhibition to go with his Bangor exhibition of 'Mathematics and Knots' for the *Pop Maths Roadshow* organised by the Royal Society in 1989 at Leeds University. From this followed another exhibition at Liverpool Cathedral, then at University of Wales Bangor, Oxford, Cambridge, Zaragoza, and Barcelona.

In view of this wide interest, in 1992 Edition Limitée decided to publish a book on the Symbolic Sculpture that included all the work I had done up to that year. They asked Ron Beaver to write an Introduction, and Ronnie Brown a Mathematical and Art related text to be included. Both men kindly agreed and for those who are interested I have included what my two friends wrote.

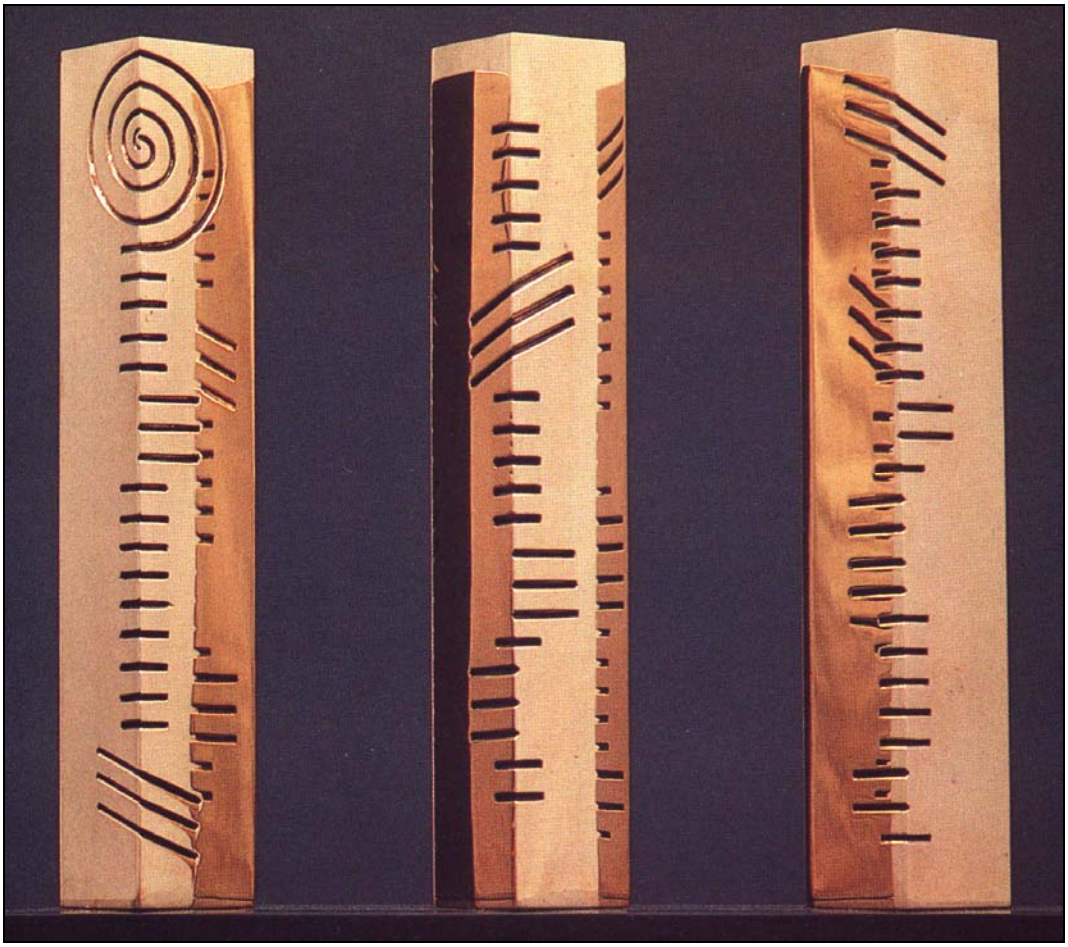
'The Universe', Melbourne

INTRODUCTION

Ron Beaver

The first of the sculptures in *The Universe Series* was created by Australian artist John Robinson in 1975. The sculpture pictured on the previous page, that won the Collins-Wales House Sculpture Competition in Melbourne, gave its name to the series. This new book covers his work to date.

For the origins of this Series, however, we should look much further back. During the 1960s John Robinson and his wife developed and farmed a tract of land in the South Australian Ninety Mile Desert for several years and it was here that this kaleidoscope of his life's material and metaphysical experience coalesced into a belief that 'The Universe is the materialisation of a Divine idea', which he expressed in the sculpture *Creed* using Ogham script.



Creed

Until the late sixties Robinson's sculpting activities were limited to occasional work when time permitted between farming activities. But then came the decision to devote his whole life to sculpture.

He was inspired by the sense that Europe was indeed the M*other of Western Culture* as expressed by A D Hope in his poem, *Letter from Rome.*

Yet here am I returning to the source.
That source is Italy, and hers is Rome.
The fons et origo of Western Man:
Athens perhaps begot. Rome was the womb:
Here the great venture of the heart began.
Here simply with a sense of coming home
I have returned with no explicit plan
Beyond a child's uncertain quest, to find
Something once dear, long lost and left behind.

Early in his European experience, Robinson's confidence in his new profession was strongly reinforced by his association with the late Enzo Plazzotta, a great figurative sculptor. There is no similarity in the work of Plazzotta and Robinson, but their ideals are identical: *The genesis of art is religion* and art is an aesthetic expression of that religion; it has been and always will be a major contribution to the way of life of the human race.

In Eastern culture, Robinson points out that the presence of the Divine is found in the harmony of all nature as expressed by the Chinese Pi disc he used in *The Universe* sculpture to symbolise heaven. In Western culture, because our religions teach us that God created man in His own image, the mystery of the Divine by tradition is depicted sculpturally as the human figure. His response to this in *The Universe Series* is to create his works within a symbolism in which the shapes found in nature are related to the values of life which occur in both the Western and Eastern minds.

In creating *The Universe Series*, John Robinson traces a path from the beginning of time to the present day, introducing tapestry where he felt that the symbolic representation could be better expressed in that medium. The whole collection symbolically portrays the earth, animals, man and woman, birth, religion, civilisation and death.

Each work is a visual interpretation of the artist's feelings; each is created in a form found in nature such as the spiral, ovoid, circle and cone. In the illustrative parts of this book the viewer will find a descriptive phrase accompanying each piece, placing them in the context of a path traced through time. Examples of the artist's feelings at the time of the creation of each work are shown in the following quotations from his letters:

Time Flux – life is change
Dependent Beings – the union of male and female
Sun Moon Ovary – we are the children of the universe, sharing matter
Wave – to feel emotion is to be aware
Womb – generation following generation
Embryo – evolving
Mother and Child – maternal love
Mortality – our own insignificance
Eternity – never-ending line
Bonds of Friendship – trust is the basis of peace
Adagio – music as expression of the aesthetic values of life

In giving visual expression to his perception of the progress of the human race Robinson seemingly adopts a positive, almost dogmatic approach, akin to, "Who will question this?" But such an interpretation runs counter to

his stated intention, which is to present 'doorways' through which the viewer may choose to enter and make their own interpretations of the symbols. He sees his symbolic works as 'visual poems'. The Series prompts the metaphysical question asked by the Greek philosophers: "What is the purpose of life?" Robinson's answer is *Know Yourself*, the message carved over the temple entrance at Delphi.

Soon after the first public display of *The Universe Series* the artist was commissioned to sculpt several of the works in larger, heroic proportions. The most important of these is *Bonds of Friendship* cast in 1980.

'Bonds of Friendship' unveiling in Portsmouth, UK

This is now a memorial to Australia's First Fleeters. This bronze has a patinated finish to denote the 'Old Country' and was unveiled by Her Majesty Queen Elizabeth II in July 1980 at Portsmouth, England, to mark the place on the landward side of the Sallyport where Captain Phillip and his crews and passengers of the First Fleet assembled for embarkation.

A second casting of this sculpture has a highly polished golden finish to denote the 'New Country' and was unveiled a year later by the Governor General Sir Zelman Cowan at the site of the First Fleet landing at Sydney Cove. The latter sculpture is a gift to the people of Australia by the Bank of New South Wales, marking Australia's bi-centenary.

In *Bonds of Friendship*, the artist was expressing his conviction that the future of civilisation depends on friendship, co-operation and trust.

'Bonds of Friendship' being unveiled in Sydney, Australia

The bronze sculptures shown in this book were cast in Pietrasanta, Italy, in limited editions of nine, the tapestries, woven in Aubusson, France, are in limited editions of six.

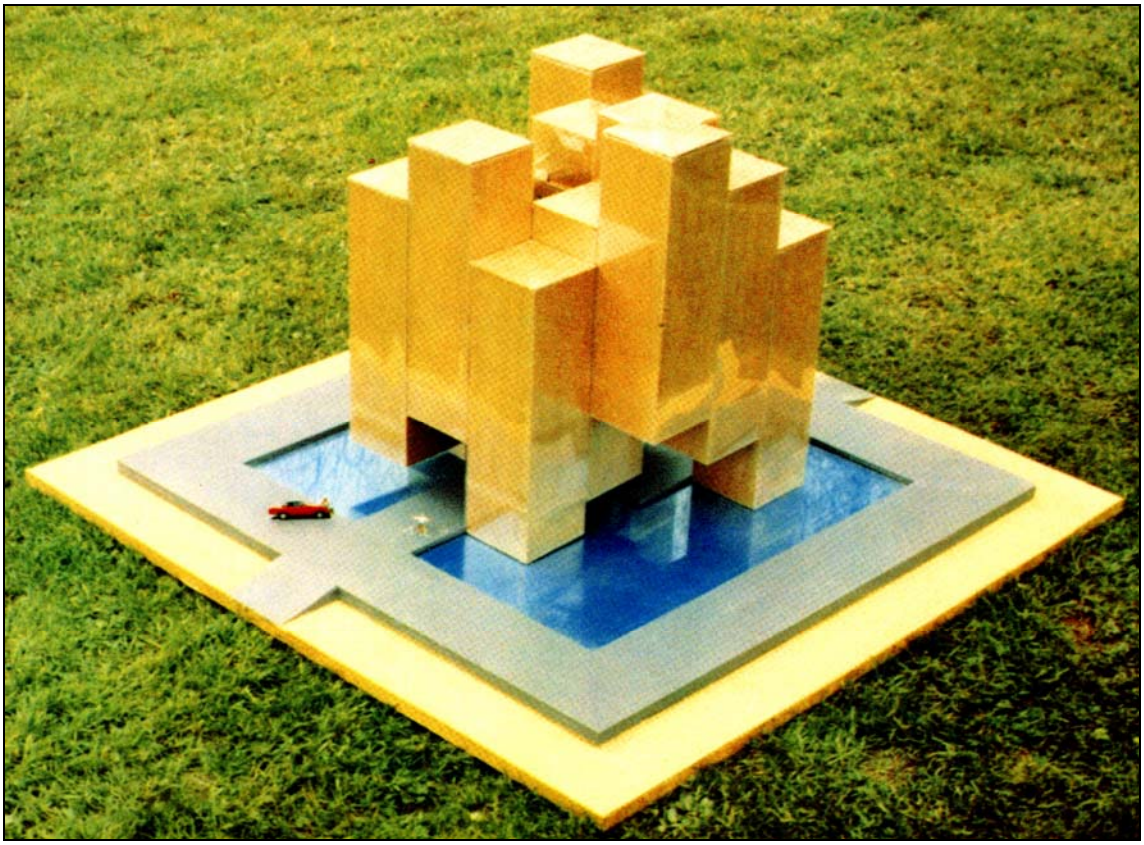
The Universe Series of Symbolic Sculptures and Tapestries by John Robinson consists at present of some 90 sculptures and 11 tapestries and continues to grow. The work has been shown at: the City of Canberra; University of Leeds; University of Wales, Bangor; Liverpool Cathedral; Wadham College, Oxford; Churchill College, Cambridge; British Association for the Advancement of Science, University of Wales, Swansea; All Hallows-by-the-Tower, London; Institute of Catalan Studies, Barcelona; University of Zaragoza in Spain.

RON BEAVER MBE, AASA

PROJECTS

Robinson has used his Symbolic Sculptures to design three buildings for Edition Limitée. None of these projects has yet been built, but as they are all unique ideas we think they are worth including in this new book.

ART FOUNDATION



'20th Century Reflections'

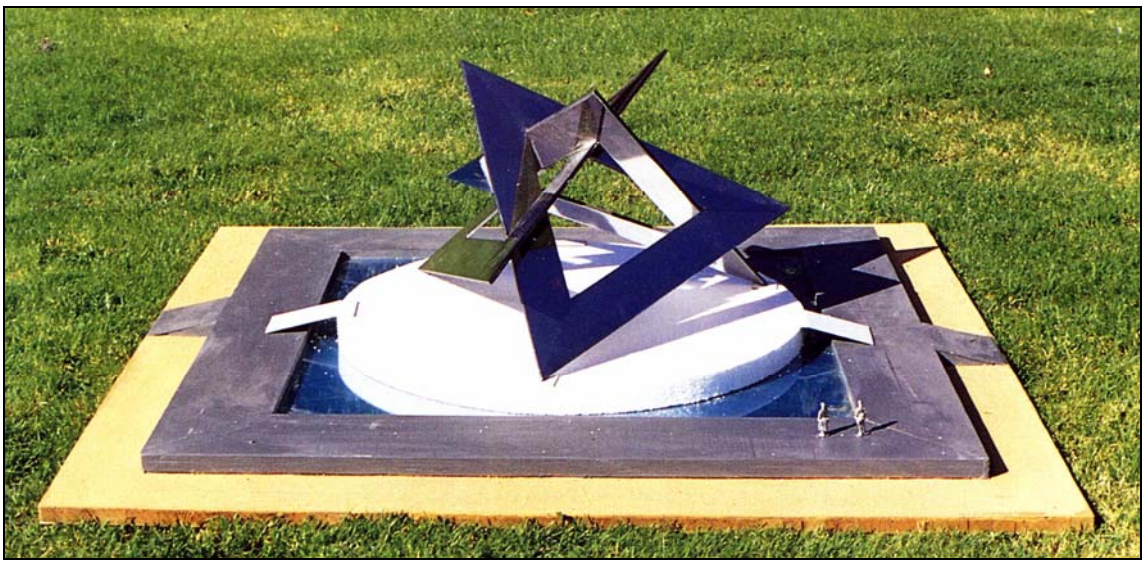
Urban Man, Civilisation, Settlement and Buildings

The building is formed out of 13 identical towers, each 20 x 20 x 70 foot plus three spaces of similar volume. The towers are joined at eight different levels into a 4 times 4 square. The building is raised from the ground by three of the towers acting as legs. The exterior of the building is faced with gold glass and stands in a shallow pool 120 times 120 foot, which reflects the sculpture. The entrance to the Foundation is in the centre of the building through one of the legs and reached by two bridges. The interior floor space is 3,600 square foot, enough to house nine Heroic Symbolic Sculptures, 30 museum-sized pieces and 11 tapestries. The building was developed by Ove Arup.

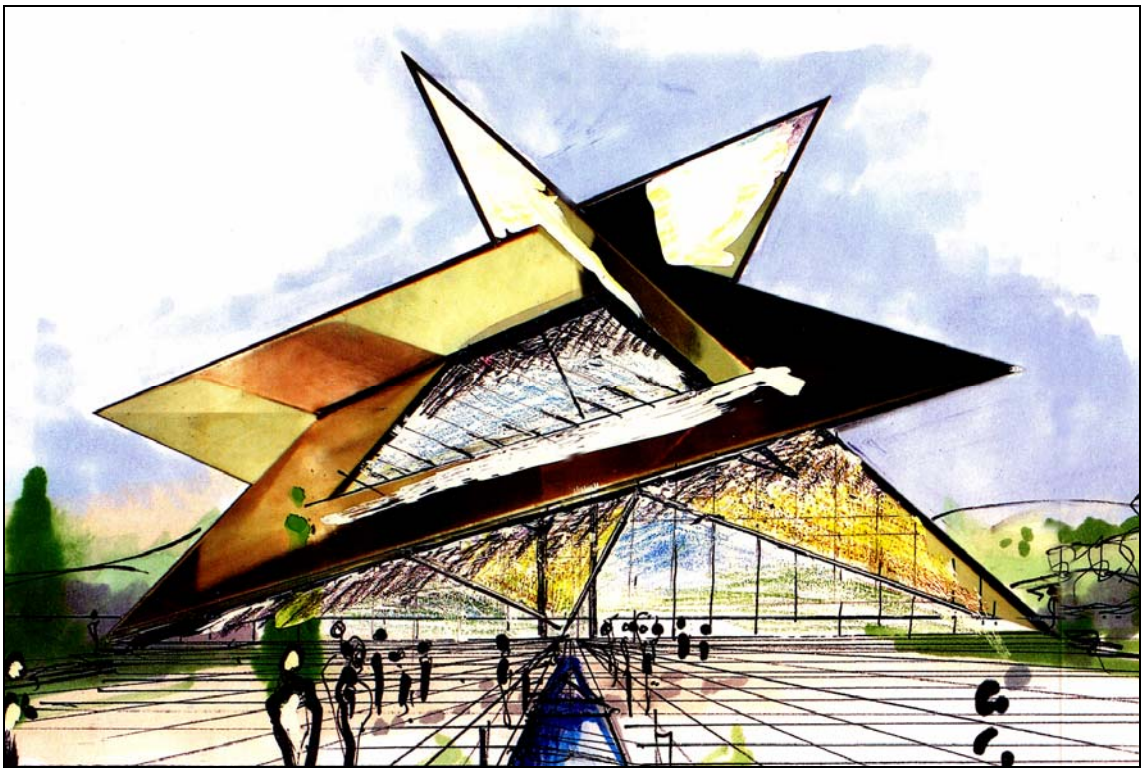
Robinson's idea is that the visitors to the Foundation would experience the feeling of being inside a sculpture.

PANTHEON

A temple to Mathematics, the building block of Science



Triangle – Circle – Square



Drawing by Ove Arup Architects

FIVE PILLARS OF ISLAM

Creed, Worship, Fasting, Charity, Pilgrimage

Dimensions : 30 m high by 8 m wide

Set in the floor of the central space is a searchlight. At night the shaft of light would reach to the stars, and the strips of light coming from the spaces between the pillars would illuminate the whole structure. The pillars would be used for water storage.

L to R : ***Dependent Beings, Bonds of Friendship, Eternity, Elation***

THE UNIVERSE SERIES OF SYMBOLIC SCULPTURES

Ronnie Brown

RB explaining the mathematics of 'Immortality' to JR

Written in the form of a conversation that took place between JR and RB in the Agecroft gardens one summer.

RB: The reactions to the Road Show exhibitions have shown the wide appeal of John Robinson's work. The strong geometric or formal content of the works has made some people think of him as having mathematical training, but until recently he has had little contact with mathematics or mathematicians. Instead, he has discovered intuitively by imagination and working with actual objects, some deep mathematical constructs and ideas, and expressed them in strong and beautifully crafted sculptures. For him and for us, these forms express emotional and symbolic values. Indeed, to express his views on the Universe, he has had to turn to symbolic forms. Perhaps the point is that to express these symbolic or philosophical ideas you have to turn to pure forms, and it is such forms that are studied in mathematics for their own structure and logic. The wider values of these forms give special impetus to this study.

It seems that Robinson, like many artists, has already been working in a way asked for by the physicist and Nobel Prize winner Richard Feynman when he wrote:

My idea was that artists don't understand the underlying generality and beauty of nature and her laws (and therefore cannot portray this in their art).

JR: Actually I think artists have always recognised this dependence on mathematics. Rodin said:

I have come to know that Geometry is at the very heart of feeling, and that each expression of feeling is made by a movement governed by Geometry. Geometry is everywhere in Nature. This is the Concert of Nature.

Maillol wrote:

My point of departure is always a Geometric figure – square, lozenge, triangle – for those are the shapes that stand up best in Space.

The Start of The Universe Series

JR: Peter Ustinov recalled that when he told his grandfather that he wanted to become an actor, his retort was, "Why not do something easy like becoming a sculptor?" I think my father would have said the same thing to me aged 16 when I left school!

Towards the end of my farming career, I started to sculpt with clay as a hobby. By then, I felt I was to some extent the master of my own existence and I had time to indulge my new pursuit. The joy of unleashing this pent-up desire was breathtaking. My first efforts were all of the human form, which I personally feel is the natural beginning for a European; for although great similarity can be found in examples of primitive art in the East and West, Western Art has found its harmony in the human figure as it has evolved with Christianity, whereas Eastern Art has, on the other hand, found its harmony in the environment, following the dictates of Eastern religions.

My excitement for sculpture was growing, and then one day I happened upon A D Hope's poem *Letter from Rome*. Suddenly I had a great desire to return to England, to explore Europe and its wealth of culture, and to concentrate solely on sculpture.

I found a furnished house in Devon, with a barn that I could use as a studio. Soon I was engrossed in figurative sculptures, ranging from children to athletes, lovers and mothers, in sizes from tiny in height to 16 feet. Luckily, I was able to sell these bronzes. My great piece of fortune was to meet the gifted Italian sculptor, Enzo Plazzotta. He introduced me to Italy, to the Foundria Mariani in Pietrasanta.

'Knife Edge', Henry Moore

I was becoming fascinated by **Symbolism**. Simultaneously, I had been studying Henry Moore's sculpture, *Knife Edge*. For me, this was of great importance, a modern symbolic sculpture making a statement about a past civilisation. The bashing club-head is giving way to the cutting edge, signifying a major turning point in humanity's development. Looking back to those days I am amazed that I found this sculpture so intriguing long before I became involved with the pre-history of *Homo sapiens*.

At this time my reading had led me to Jung. The greatest mental 'Awakening' for me has come from the books: *Man and his Symbols*, conceived and edited by Carl Jung; *Memories, Dreams, Reflections* by Carl Jung; *Jung and the Story of our Time* by Laurens Van der Post. These books changed my perception of Life, because they changed my vision.

Jung writes in *Man and his Symbols*:
The Artist is, as it were, not so free in his creative work as he may think he is. If his work is performed in a more or less unconscious way, it is controlled by laws of nature that on the deepest level, correspond to laws of his psyche, and vice versa.

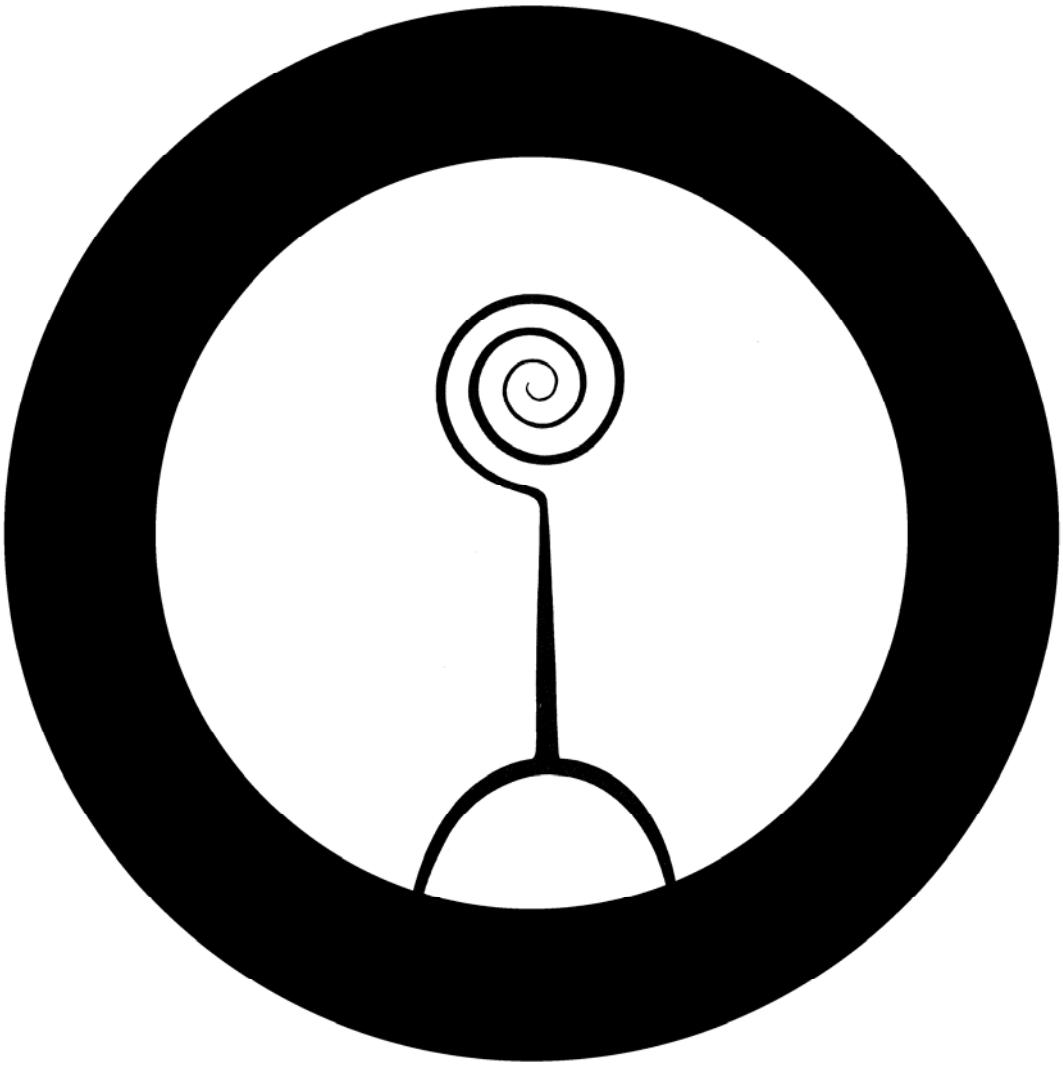
For me, this passage helped everything fall into place. I have come to believe that artistic inspiration comes from the 'Unconscious'. Jung was not inferring that Artists were not aware of this fact as Maillol said: *I consider that I make statues as an apple tree gives apples. It is in me and I give what I have.* While Matisse said: *You wait outside while the bread bakes.*

My mind was engrossed with Symbolism. One evening, after listening to Mozart's Third Violin Concerto, and thinking about the commencement of the Adagio movement where the solo violin theme grows and swells into a beautiful phrase. An image appeared in my mind's eye that captured that moment. I could see it in three-dimensional form. I could turn it and view it from above and below. I felt as if I could practically touch it. Next day I made the sculpture *Adagio* in plaster. The experience was as exciting and intense as I have had in my life.

Adagio

If music could conjure up images, I asked, then surely so could other important values of life. Love, birth, mortality, immortality, ecstasy, elation, eternity, space. Over the next three or four years, I pictured some 90 sculptures and 11 tapestries. The sculptures were always basically gold, the tapestries presenting themselves in bold colours. Latterly I have used stainless steel, wood, neon lights and granite.

The works of *The Universe Series* are created within a symbolism in which the shapes found in nature are related to the values of life. The *Series* traces a path from the beginning of time to the present day, symbolically portraying my interpretation of the cosmos, earth, animals, man and woman, birth, death, religion, civilisation, and the future. I named the collection *The Universe Series* after my sculpture *The Universe*, which collectively represented 'The Known, the Unknown, and Man'.



'The Universe', The Known, the Unknown, and Man

Geometrical Forms in The Universe Series

RB: John Robinson's symbolic sculptures are often based on simple geometric forms: spirals, ovoids, cones, circles, spheres. These are used and combined in subtly proportioned ways. Many of the sculptures are cut from an overall form, whose omitted space is sometimes hinted at rather than seen.

Ovoids

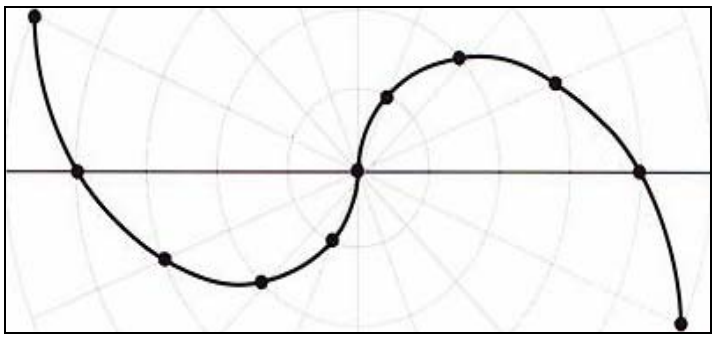
RB: The ovoid, the Symbol of Life, is one of the most recurring leitmotifs that permeate Robinson's symbolic approach to abstract sculpture. *Conscience*, *Womb*, *Courtship Dance*, *Conception*, *Embryo* and *Maternity*, all show this form. The way the curvature of an ovoid varies is very subtle, and a geometer examining Robinson's ovoids can see no mistakes in displaying the appropriate curvature of his egg-shaped objects.

Conscience

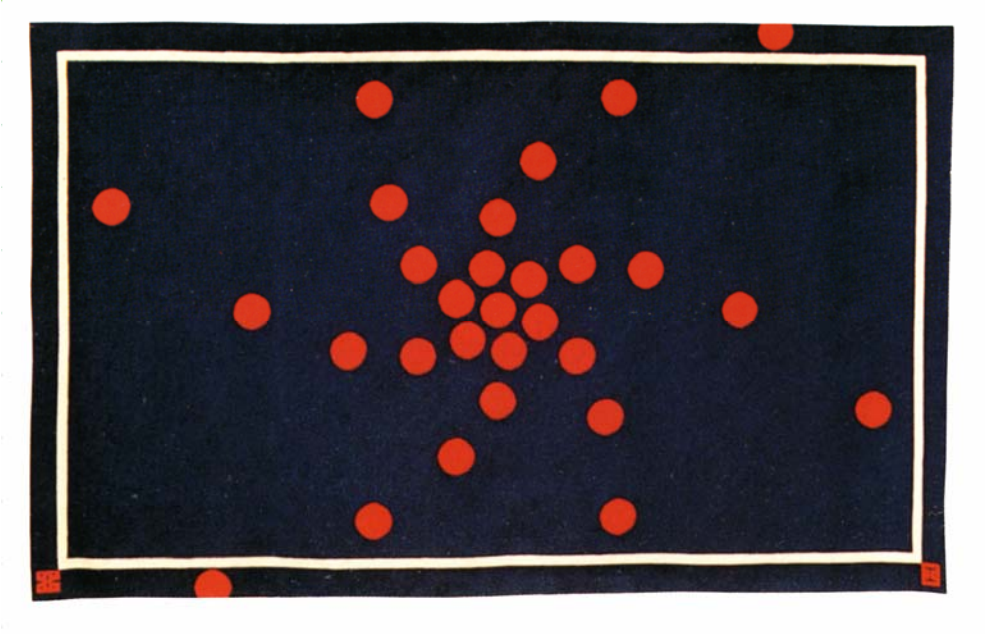
Maternity

Spirals

RB: *Conception* and *Embryo* also contain the spiral. The spiral is taken as the symbol of mystic knowledge. This symbolism is a crucial aspect of Robinson's view of the nature of man, and is also seen as 'male and female mystic knowledge joining'. Again, *Man Child* has both the ovoid form, and the spiral. Some of Robinson's spirals are the Archimidean spiral that is the locus of a point on a rotating line, such that the point moves outward uniformly as the line rotates. The equation of the spiral in polar coordinates ($r\,\theta$) is thus given by $r = c\,\theta$, for some constant c.



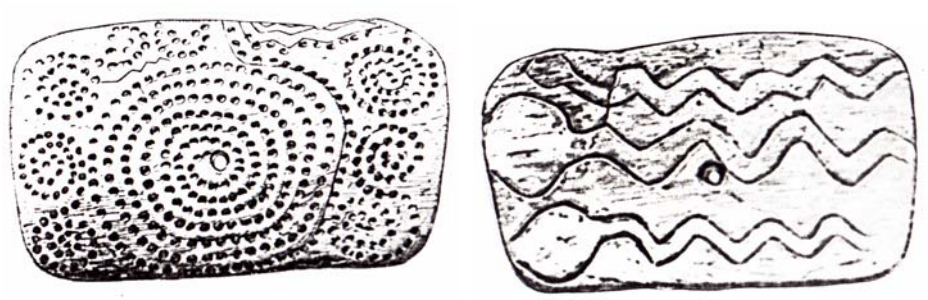
JR: Since accidentally finding how to compose this spiral, I have found that Escher did the same thing for his *Path of Life* woodcut.



Galaxies

RB: The basic form of *Galaxies* is a spiral, suggesting the *'expanding galaxies spreading out beyond the realms of light'*, represented by the band of white. The spiral may also be seen in the sculpture *Innocence*, if it is looked at from the top, down the axis of the imaginary cone on which the form lies.

JR: The spiral is found in nearly all primitive forms of art from the European Celts to North Americans, Etruscans and Australian Aborigines. It has been used for many thousands of years by mankind as a symbol of great meaning; it seems to have represented mystic knowledge and was a form of protection against the Unknown, an aid to seeking supernatural intervention. One of the oldest-known handmade spirals, found at Mal'ta in Siberia, date from about 16,000 BC, in the Upper Palaeolithic. On this ivory medallion with pierced centre is one large spiral, a small spiral and three pairs of returning spirals, all made by drilling. The spiral starts from a hole in the centre of the medallion and if you go through the hole to the other side you find three figurative snakes.



Mammoth ivory found in Siberia dated 16,000 BC

From 1976 I used the returning spiral in four sculptures, *Birth Cycle*, *Marriage of Minds*, *Mother and Child*, and *Conception*. One responds naturally to such a charged symbol. The Double Spiral as a symbol of Birth, Death, and Rebirth.

Birth Cycle

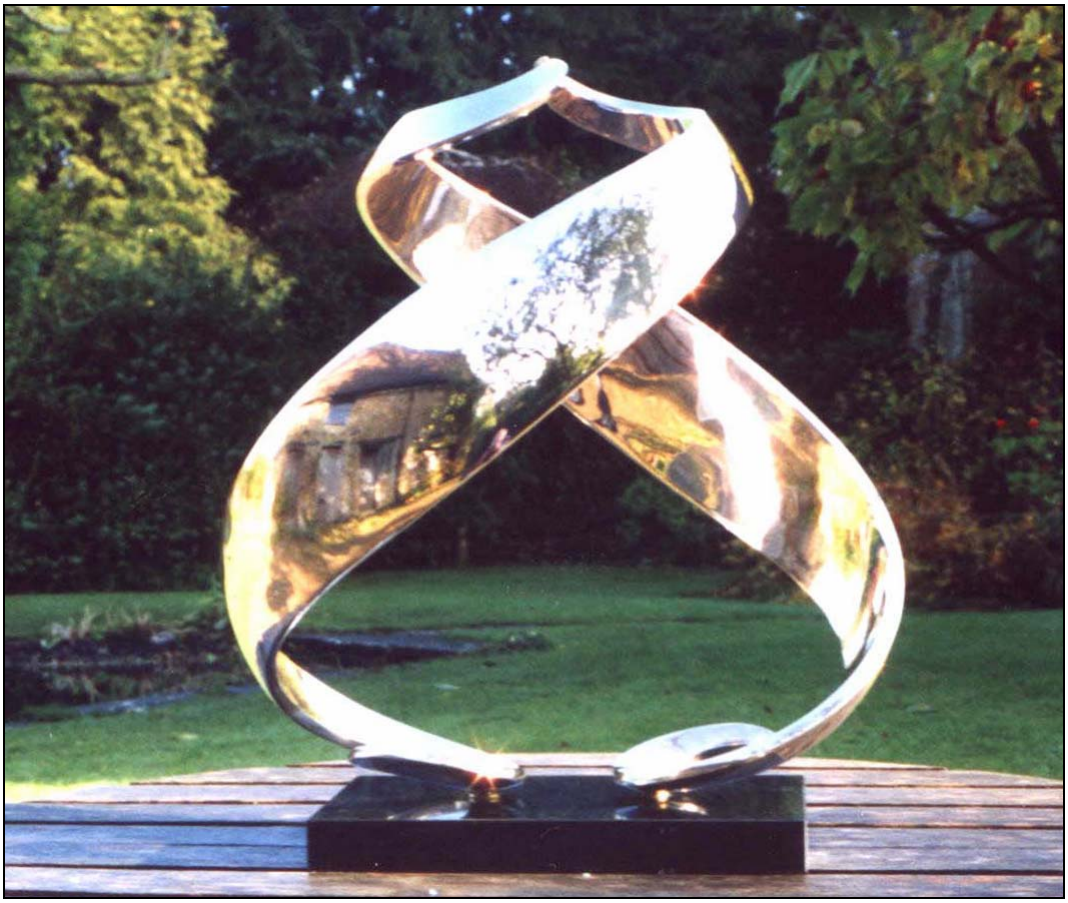
Conception

Mother and Child

'Eternity', photograph by Andrew Begg

Eternity came to me in 1981 and itself is a never-ending spiral.

Courtship Dance is made of two spirals, each cut from an ovoid. To me the male and female forms are sensing the attraction of union, the universal prologue to creation. The inspiration came from seeing the dance that brolgas (giant cranes) do as they court twisting their necks together. Watching this scene in Kimberley is a treasured memory.



Courtship Dance

A bronze edition was purchased by the University of Wales, Bangor, in 1990, which makes it special as I was elected an Honorary Fellow of that University in 1992, an act that ranks amongst the most flattering things that has ever happened to me.

Omitted Forms

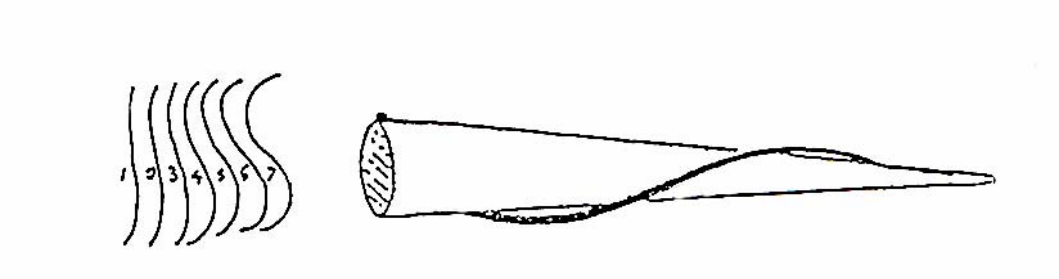
RB: *Courtship Dance*. The blind mathematician, Bernard Morin, pointed out on his visit to Bangor in 1990 that what produces the amazing effect of this work is that despite the fact that the two lunes of each part do not intersect, the two ovoids from which they are taken intersect along an oval curve passing through the little ends of the two eggs, so that eventually the two lunes meet there like two beaks. The structure of the sculpture relies on this invisibly organising intersection curve.

The form of *Innocence* is of a narrow spiralling triangle of bronze on a cone, from the vertex to the base. The cone is hinted at by the base, which is a section of a cone, cut to reveal an ellipse. The shape of the cone is also intimated by the lune, so that the form is defined by what is omitted as well as by what is there.

Innocence

JR: The three sides of each tile in *Music of the Spheres* are 'Lines of Beauty'. This is expressed in William Hogarth's book *The Analysis of Beauty* (1753). He defines the 'Line of Beauty' as a thin wire that starts at the point of a cone, and winds down and round the cone to its base. He proposed

seven different lines, of which number four Hogarth named the *Line of Grace*. He employed this line in his painting compositions, and I believe it can be seen in all balanced paintings and sculptures, and is one of the connections between Mathematics and Art.

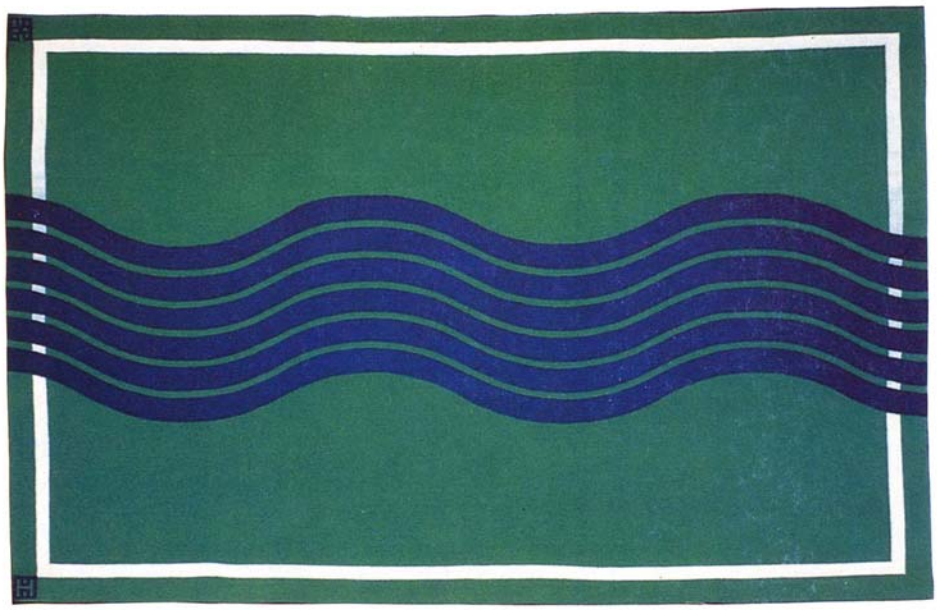


'Analysis of Beauty' by William Hogarth

Music of the Spheres is a similar form as *Eternity*. The cross-section reflects the elaborate tile pattern found on the walls of the Harem in the Alhambra Palace, Granada, Spain.

Music of the Spheres

I also used the lines in a tapestry that depicted a river flowing in and out of Time that I called *Time Flux*.



Time Flux

Cones

Also lying on cones are *Love Knot* and *Wave*.

Love Knot

Wave

Knots

RB: One striking aspect of Robinson's sculptures is the use of what mathematicians call knots and links. A 'link' should be imagined as one or more loops of string, wire or tubes entangled to a greater or lesser degree. If there is only one loop or strand, mathematicians call the link a 'knot'. In Knot Theory, we study the form of a link or knot, not its strength or other qualities of interest to a practical knot tier.

A scientific reason for studying knots and links arose in 1867 with Kelvin's vortex theory of atomic structure, in which atoms were thought of as knotted or linked vortices in the ether. As Kelvin wrote:

Diagrams and wire models were shown to the Society to illustrate knotted or knitted vortex atoms, the endless variety of which is infinitely more than sufficient to explain the varieties and allotropies of known simple bodies and their mutual affinities.

This theory of atomic structure was abandoned, as it quickly became evident that the classification of knots and links had no correspondence with the list of elements, as given in the periodic table. However, the theory did inspire two important pieces of scientific work: first, continued work by Kelvin on the hydrodynamics of vortices; and second, a long study by the Scottish physicist, P G Tait, of the classification of knots.

Since that time, knot theory developed as a corner of the subject of topology, showing a delightful blend of algebraic and geometric insight. Suddenly, in the last few years, what might be called a new version of Kelvin's insight has appeared. Knot theory has become big scientific business, with large research grants, and applications ranging from the analysis of knotted and linked DNA to statistical and quantum mechanics. Sir Michael Atiyah writes:

The ideas that Kelvin was trying to apply at the atomic level are now in a new guise, being applied at an even more fundamental level. In a sense, Kelvin was on the right track and a long way ahead of his time. He would undoubtedly be both amused and impressed at the way, a century later, knots have re-entered physics.

It is thus a particularly appropriate scientific time in the development of science to have Robinson's strong and beautifully crafted symbolic sculptures brought to our general attention.

Immortality

The form of *Immortality* is a trefoil knot. The sculpture is made of a single band of bronze, and this band is itself in the form of a Möbius band, so that it has only one side and one edge.

The trefoil knot is the simplest knotted form of a class of knots called *torus knots*. Here a torus is the shape of a doughnut. Mathematically, it is obtained by rotating about the z-axis a circle in the (x,z)-plane of centre $(a,0,0)$ and radius b where $b < a$.

The surface can be coordinatised by two circular coordinates, θ, Φ. Say, where $0 \leq \theta, \Phi < 2\pi$, where θ gives the angle from the centre in the (x,z)-plane, and Φ gives the angle of rotation about the z-axis (Fig. 1).

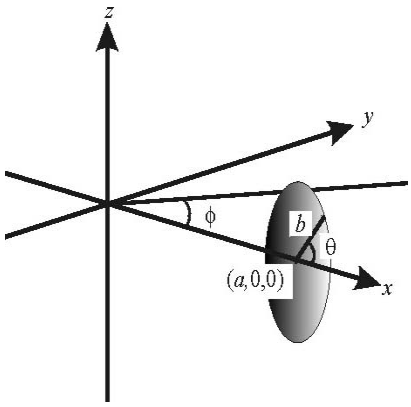


Figure 1

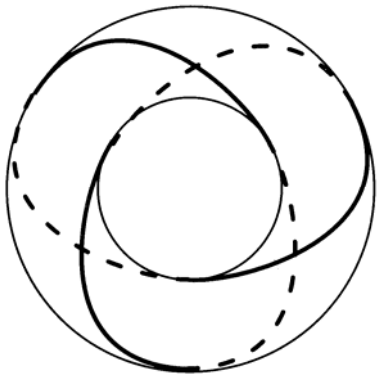


Figure 2

The path of the centre (a,0,0) in the rotation is called the core of the torus. The 'torus knots' are those closed loops which can be drawn on a torus. The trefoil is called a (3.2)-torus knot, because it winds round the core three times, and around the central axis twice (Fig. 2).

The most complex of the torus knots that Robinson has made is the sculpture he calls *Rhythm of Life*. This is a (15.4)-torus knot, so that it is a single band of bronze winding fifteen times round the core and four times round the central axis. You can picture it by drawing two concentric circles, which give the top view of the torus. Mark off on each circle 15 equidistant points, so that pairs of points, one on each circle, lie on a common radius. Label these points 1 to 15 as on a clock with 15 hours. Now join 15 on the outside to 2 on the inside, representing a strand over the torus, and join 2 on the inside to 4 on the outside, representing a strand under the torus. Now repeat all the way round. You end up with a single strand.

Note that the numbers 4 and 15 are not prime numbers, but they are coprime: only 1 divides both 4 and 15. In general, you may obtain a torus knot with one strand for any coprime numbers m, n. Such a knot consists of the set of points on the torus $(m\,\theta, n\,\theta)$ for $0 < \theta < 2\pi$.

Rhythm of Life

JR: *Rhythm of Life* is my form of DNA, suspended and revolving within the Universe. I discovered this sculpture by wrapping a ribbon around an inner tyre tube. It was a marvellous surprise when, on its fourth trip around, the ribbon returned to its point of origin (Fig. 3).

RB: The sculpture *Gordian Knot* is made of a single tube of bronze closely intertwined with itself to make a shape of a solid torus. The single tube forms a knot. If we imagine this knot as flexible, and then pull it apart to wrap round a torus, the knot becomes a (8.3)-torus knot (Fig. 4).

Gordian Knot

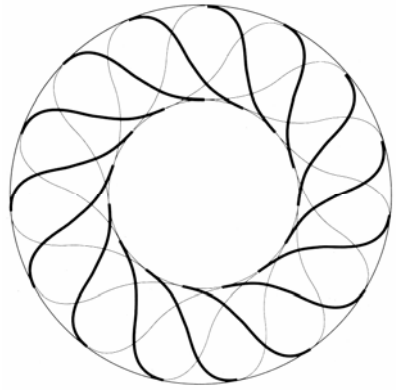


Figure 3

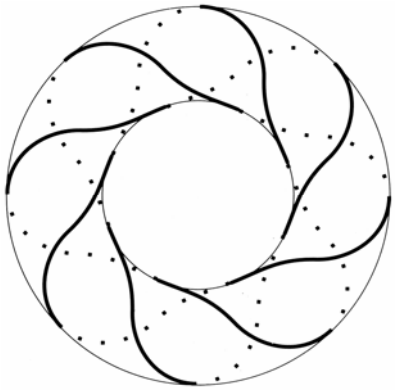


Figure 4

RB: *Bonds of Friendship* is made of two linked toruses. This is the simplest of what mathematicians call a link, which is a tangle of loops made up of several strands.

JR: *Bonds of Friendship* to me symbolises trust, the basis of peace and civilisation, from man to man, and nation to nation.

Bonds of Friendship

RB: Other sculptures of Robinson's also use knot themes as an underlying structure. *Conscience* is based on a trefoil knot, formed on an ovoid shape. Figure 5 gives a diagram of its structure and transformations of this diagram to explain why the form is of a trefoil knot.

Figure 5

Conscience

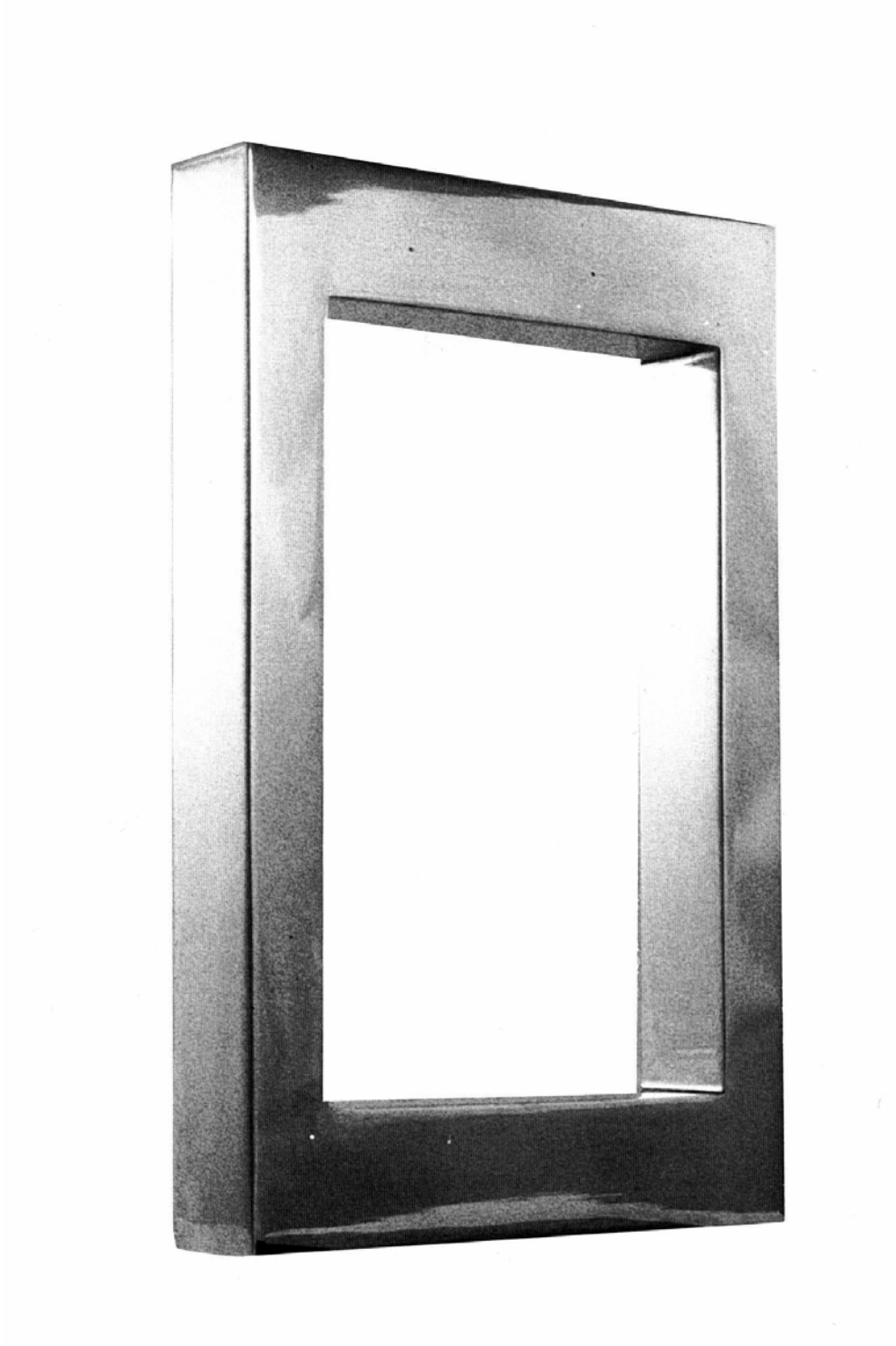
JR: Knots to me are a symbolic art form. The West has nearly lost its use of knots as a visual symbol, although we still talk about 'tying the knot' and 'the bonds of friendship'. In Oriental cultures, especially Japanese, the use of knots as a symbol is very much alive. Every wrapped present given by a Japanese is symbolically knotted. To quote from information I received from a friend about the Kimono and Obi:

Historically there existed a belief in the magical power of tying things, which was equated with the establishment of a connection, it is believed possible to transfer one's love or spirit through the tied knot and if the strands of the knot were unified, a new value could be created, just as a new value, a child, is created through the union of man and woman. From very early times people exchanged knots of love or knots to act as amulets to ward off evil or injury. Musubi, the word for 'knot', was sometimes written with the Chinese characters meaning 'living spirit', and the knot was regarded as being the resting place of the soul.

Golden Section

JR: I read that it is traditionally held that Plato began the study of the Section as a subject in itself. The Section is the basis of Greek architecture such as the Parthenon. To the Pythagorians the Section became an important symbol of recognition between themselves and was actually referred to as 'Health'. Leonardo da Vinci's friend, Luca Pacioli, the mathematician, wrote a book on the Golden Section called *Divina Proportione*.

RB: Golden Section $a : b$ is given by $a/b = b/(a+b)$, which leads to $b/a = (\sqrt{5}+1)/2$, or approximately 1.618. It is a consequence of the definition that if one draws a rectangle with sides in the Golden Section (*a golden rectangle*), and then removes from it a square, the rectangle that remains has the same proportions as the original.



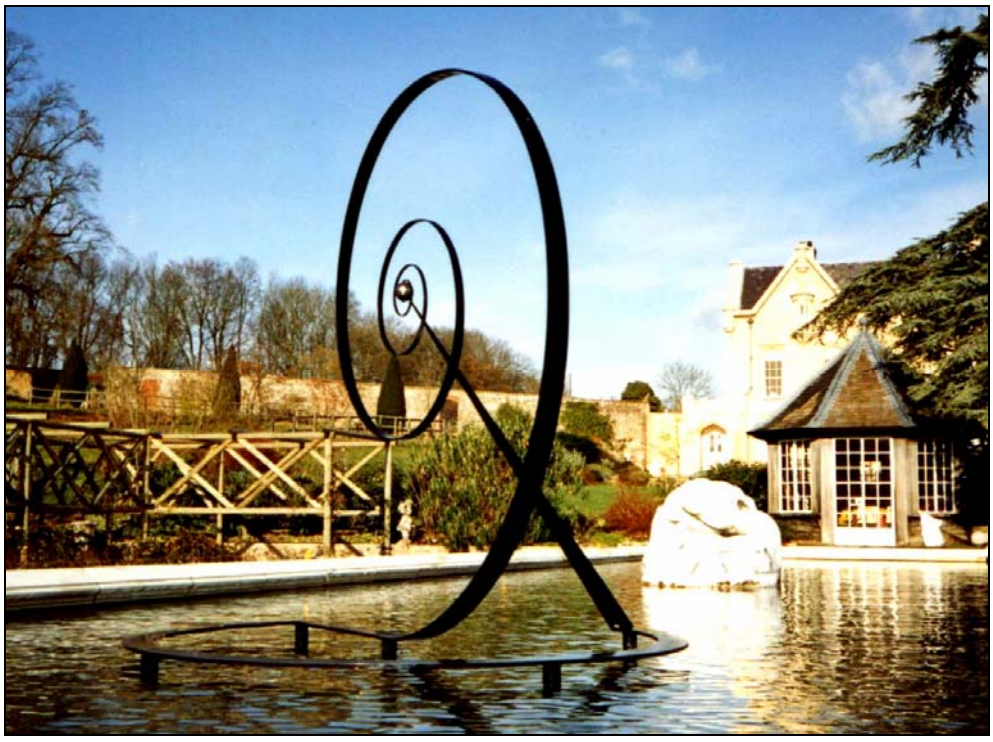
Golden Rule

JR: What does all this mean to me, the sculptor? As an artist I am fascinated by the apparent magic of the *Golden Rule*. Are we programmed in some way to appreciate the proportions of 1.618 and its inherent harmony and balance, or is it coincidental? I don't know and I don't suppose anyone else does either. I can only talk as an artist. Geometric forms and proportions excite my imagination, and when placed in conjunction with personal emotions, my unconscious translates them into sculpture. Structured Patterns x Imagination = Creation, something which also intrigues mathematicians.

Elation

Elation for me represents joyfulness and exaltation of spirit. The ratio of the sizes of the two parts of the sculpture approximates the Golden Section. Since meeting the mathematicians I have been introduced to the Phi Series spiral: 1.618 (Golden Section)… 2.618, 4.236 etc. It is marvellous to play with these numbers in association with geometry. When experimenting recently with the spiral I discovered that the side of the hypotenuse is always equal to the radius. If you draw an isosceles triangle the equal sides become the radius that produces that section of the spiral. The same applies to all other sections of the spiral. I found that all the centres of these radii are on two axes that run through the centre of the spiral at 45°. The axes are the *Golden Section.*

By enclosing the spiral in a rectangle, the greater angle of the triangle caused by the diagonal is 52°, the angle used by the Egyptians for the sides of the Pyramids. I used this finding to create a sculpture using a spiral in conjunction with a pyramid. I call it *Point Omega.*



Point Omega

Fibre Bundles

RB: A deep mathematical construct that appears in Robinson's work is what is called a 'fibre bundle', of which one of the simplest examples is the Möbius Band. This band is made up of two elements: a circle, as you go round the centre of the band; and the cross-section, which is simply a line segment. However, as you go round the band the line segment twists, and when you go round once, the line segment has twisted through 180°. This idea of 'moving round the band', i.e. looking at the behaviour of the cross-section as it is transported around the circle, is also an important idea in mathematics, and its applications in the physical world. It is called by mathematicians 'holonomy'.

A classical example of this is to consider a pencil resting at the North Pole on a globe. The pencil has length and direction. Now move the pencil as follows: in its given direction down a longitude to the equator: parallel to itself around the equator for 90°: back North up the appropriate longitude to the North Pole. Throughout this motion around a circuit the pencil has moved parallel to itself although at the end it has turned through 90° relative to its initial position. This phenomenon is stated by Michael Berry in the following form, and with other scientific applications:

[it] illustrates how the 'parallel transport' of a vector (a quantity that has both length and direction) around a circuit on a dosed surface results in an holonomy: the failure of certain variables describing the system to return to their initial values. In 1983, I found that a similar geometric effect exists in the quantum waves that describe matter and its interactions on the smallest scales.

JR: In 1990, Ronnie Brown introduced me to the renowned geometer, Bernard Morin. Bernard, who lost his sight at the age of six, spent a day with Ronnie and myself in the studio and it was fascinating to watch him feel my sculptures and to hear his reactions. As he ran his hands around *Conscience*, he declared, "Ah, a right-handed trefoil." When I gave him the maquette of *Rhythm of Life* he declared, "Ah, 15.4." His insight to my sculptures, from such an original stance, was extremely rewarding to me. He showed me some models he had had designed to illustrate the moves in turning a sphere inside out. One was a model with flat faces of the famous Boy's surface. It included a central Möbius Band. I have now made a variation on this into a sculpture, which I called *Journey*.(p617)

RB: Bernard Morin is not the only blind mathematician. There is also the famous Russian topologist, L Pontrjagin, and many others. The achievements of these men illustrate that in mathematics as in art it is not sight that is required but vision, the ability to develop and imagine new forms and relationships; the craftsmanship of the worker is the servant to the vision.

The fibre-bundle structure, which is seen in one of its simplest forms in the Möbius Band, appears again in the sculpture *Eternity*. Overall, this has the form of a tube. However, the cross-section of the tube is a triangle rather than a circle, and as you move once round the tube the triangle has rotated through 120°. Three turns around the tube bring the triangle back to its original position. The structure is called by mathematicians a 'fibre bundle over a circle with fibre a triangle'. Note the form has one edge, which is in fact a torus knot.

In *Dependent Beings*, we have a fibre bundle over a circle with fibre a square. In moving once around the circle, the square has rotated through 180°, which explains why the edges of the square form as they move two surfaces, the 'dependent beings' of the title. The vertices of the square form as they move two linked circles, like in *Bonds of Friendship*.

Another way of explaining *Dependent Beings* is that it has the form of a Möbius Band in which the thickness of the band has been increased until it has the cross-section of a square.

Dependent Beings

In *Music of the Spheres* (p 595), the form is a fibre bundle over a circle with cross-section. It is also a famous tile from the wall of the Harem in the Alhambra, in Granada, Spain. The form of the tile is created by arcs of six circles, which themselves form part of a well-known pattern of ten intersecting circles (Fig. 6). This tile is notable because its repetitions fill the plane (Fig. 7), called the Andalusian Pattern. Again, there is a three-fold symmetry of the tile which makes up the fibre, and the vertices of the tile describe a path which is a (3.1)-torus knot. He also used the tiles to form a pyramid calling it *Prometheus' Hearth* and pointed out with a laugh that if you take away the first or last letter of Hearth you are left with *Heart* and *Earth*, but also *Art* in the middle.

The torus knots *Rhythm of Life* (p 600), and *Gordian Knot* (p 601), can also be regarded as fibre bundles over a circle. In the first case, the fibre consists of four small rectangles each being the cross-section of the band of bronze; in the second, the fibre consists of three touching circles, each being a cross-section of the tube which makes up the sculpture (Fig. 8).

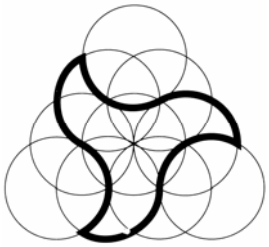


Figure 6

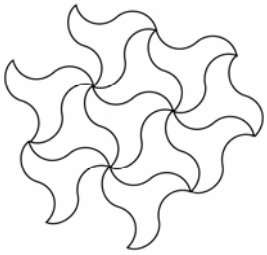


Figure 7

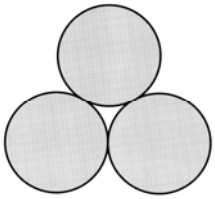
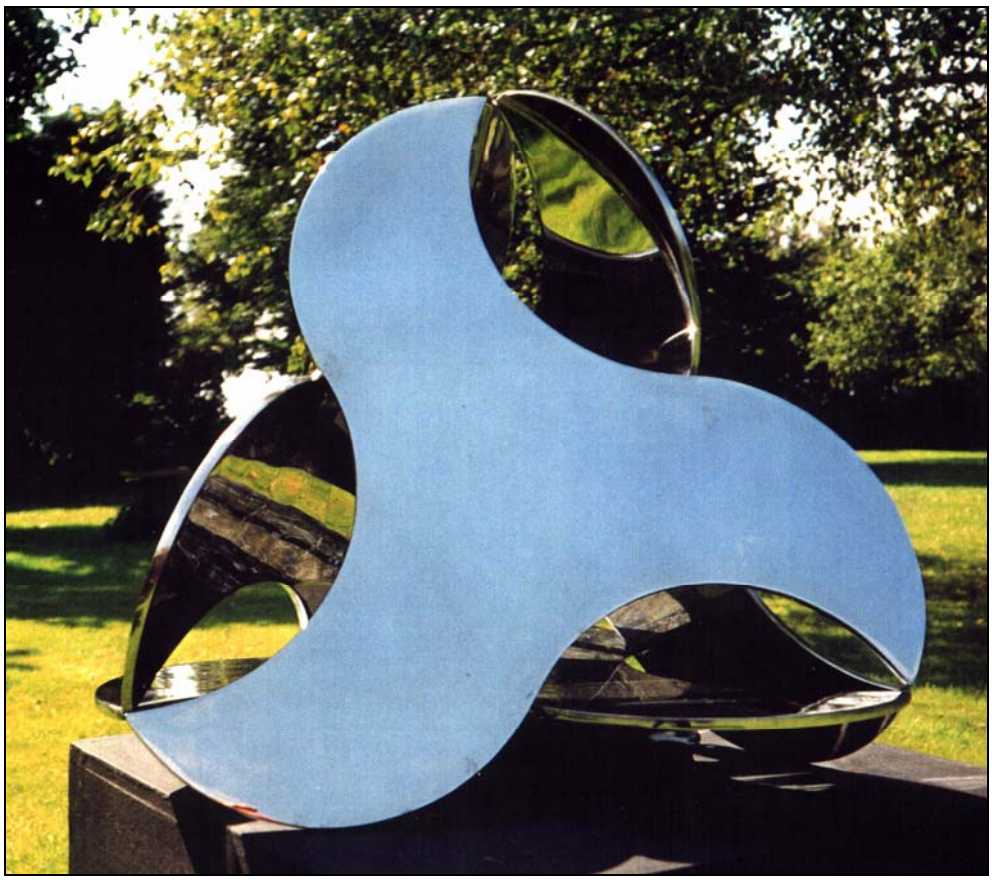


Figure 8



Prometheus' Hearth
Frome College: mathematics and Art School 2006

Borromean Rings

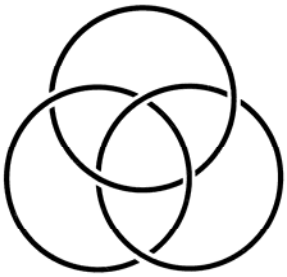
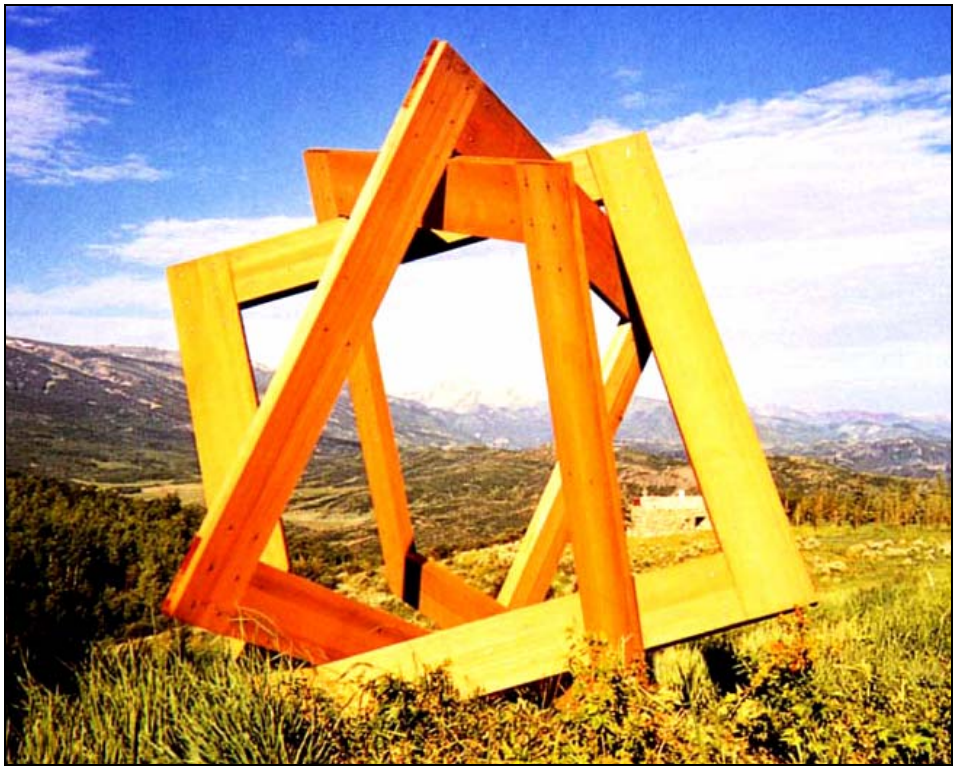
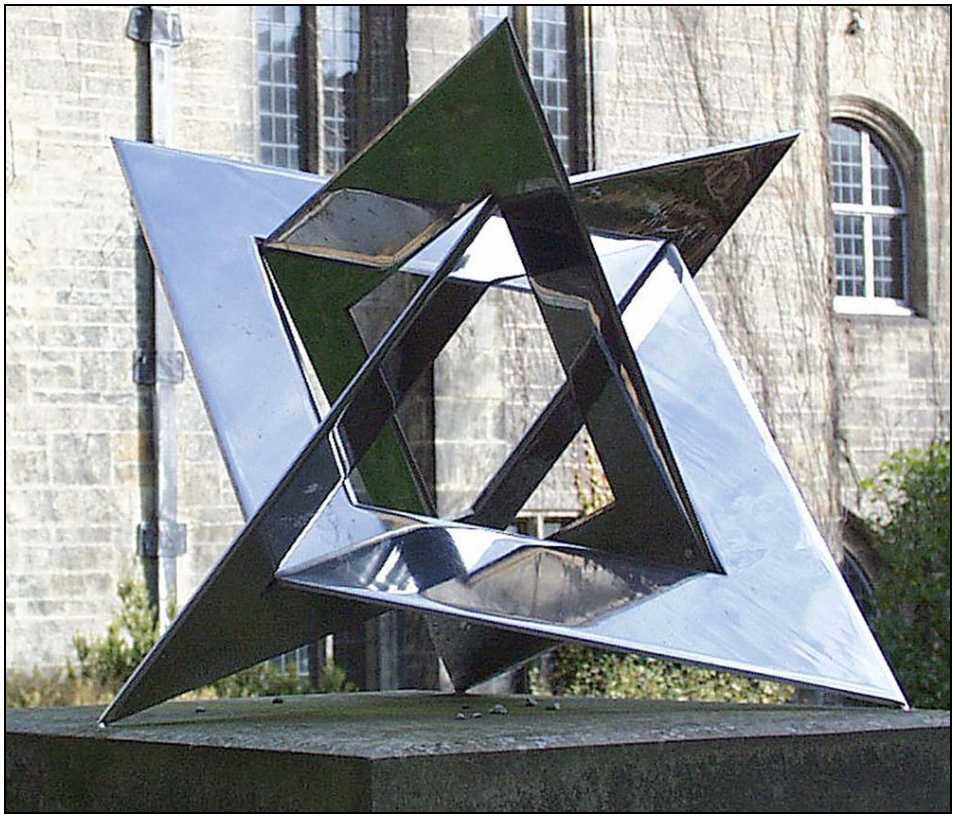


Figure 9



'Creation', Ramiiilaj

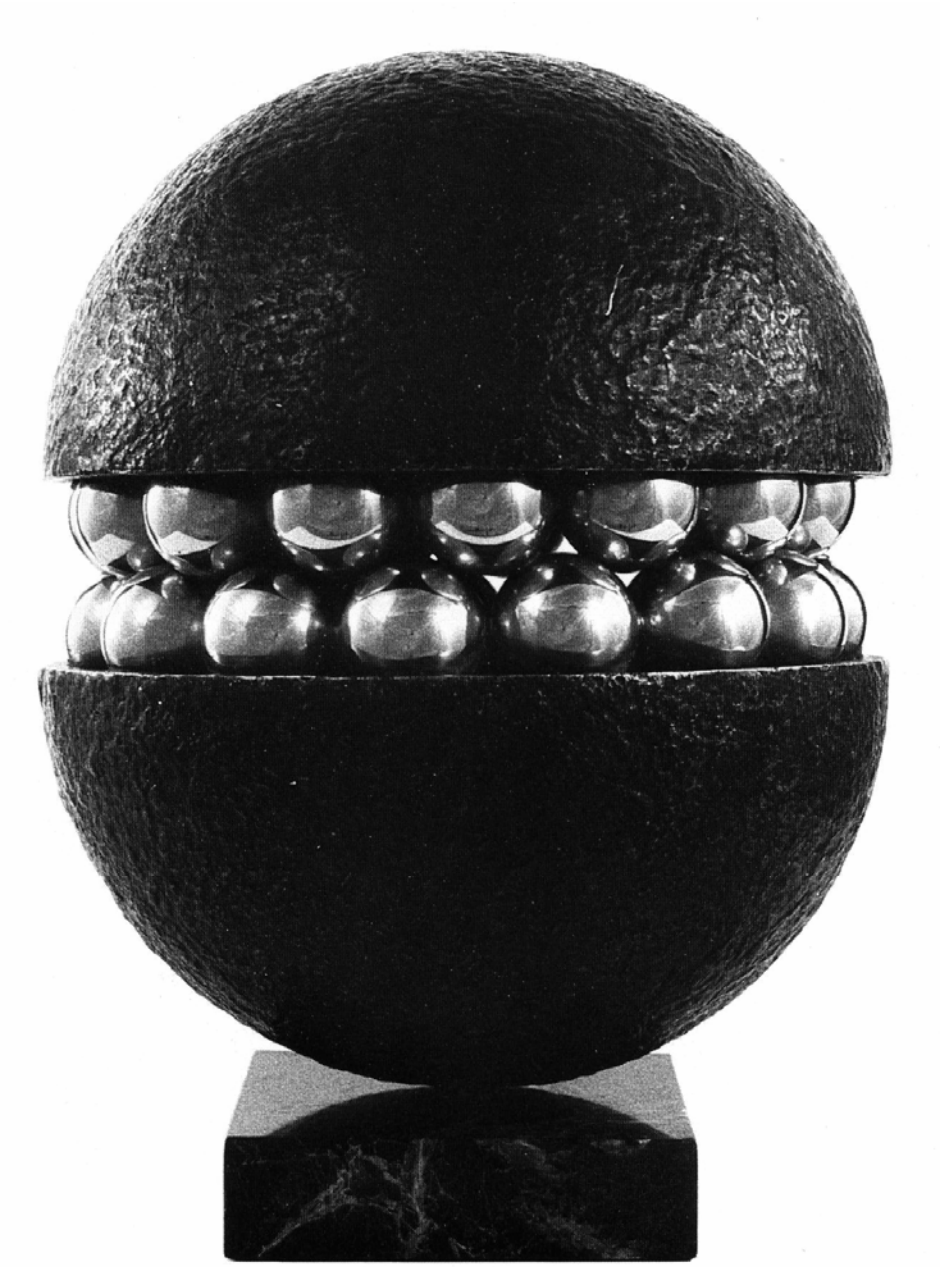


'Genesis', University of Wales; Isaac Newton Institute Cambridge; Yeovil Hospital 2007

The Borromean Rings (Fig. 9) are a famous example of a link made up of three loops. The amazing feature is that no two of the strands are linked, but it is impossible to separate the three strands without cutting. Thus the structure forms a whole which is more than the sum of its parts. Robinson has changed the circular rings into squares, triangles and rhombuses, and found the sculptures *Creation*, *Intuition* and *Genesis*.

Spheres

RB: Other geometric forms in John Robinson's work are *spheres*, as seen in *Sun Moon Ovary*, and *circles and tangents*, as in *Transcend*.

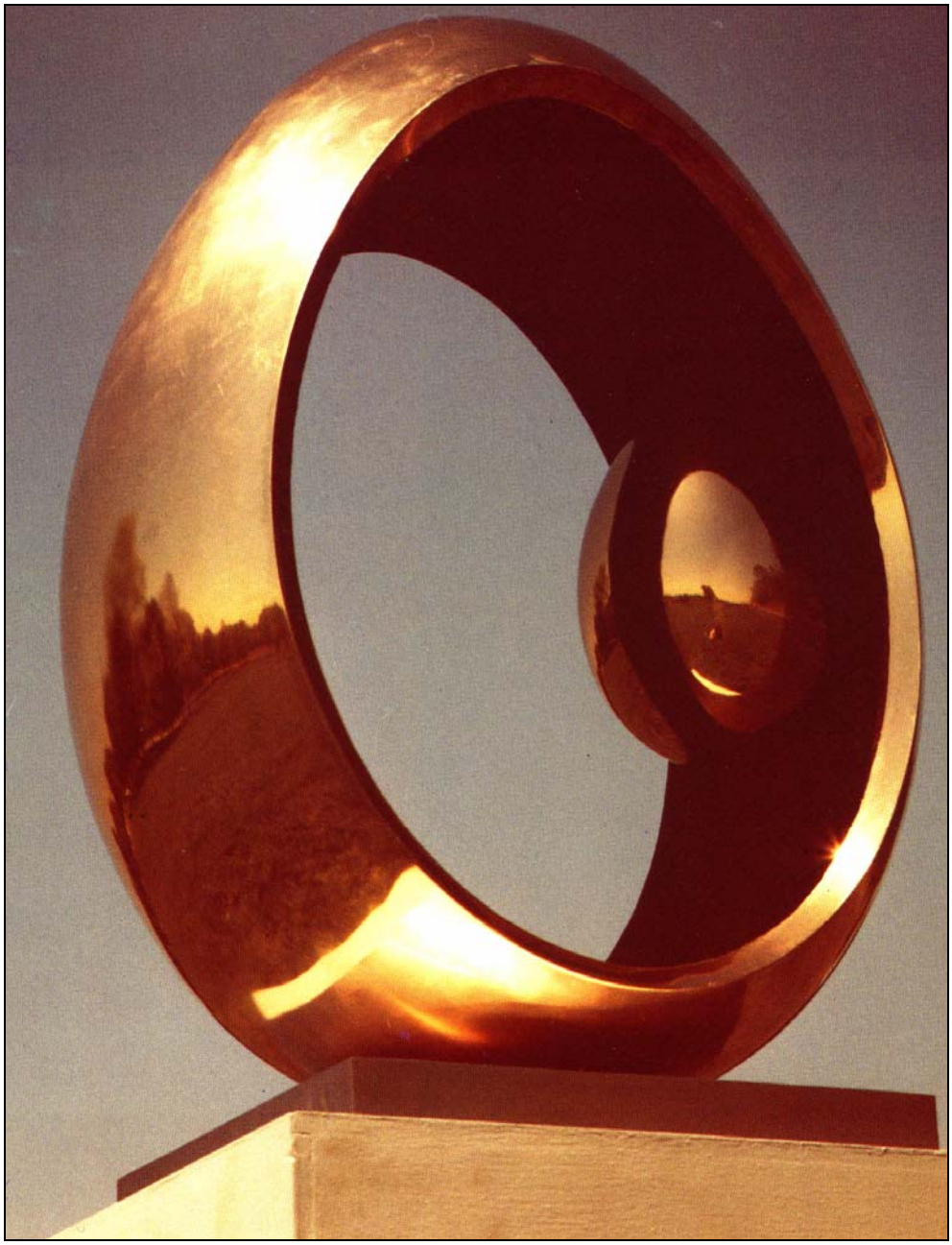


Sun Moon Ovary

Transcend

Containment

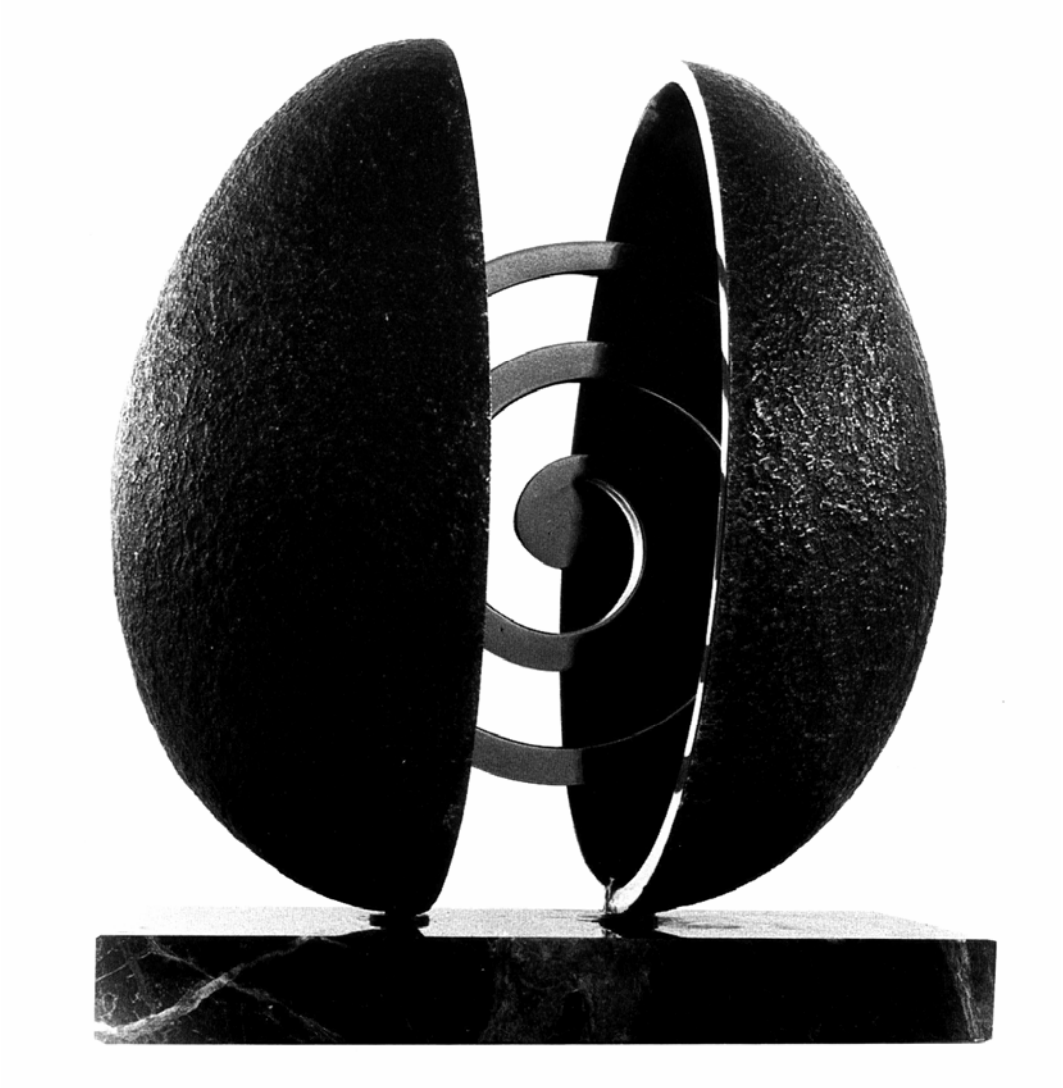
The theme of containment is seen in a number of sculptures, but particularly in *Womb*, *Sun Moon Ovary*, and *Man Child*.



Womb

In an attempt to describe the kinship of the Arts to Mathematics, I would say that we often think of Mathematics as abstract, and so perhaps unreal. Mathematics is abstract, because it is not so much about objects themselves, as their relations to one another. The surprise is the way in which similar relationships occur in extraordinarily different situations.

Here is what the mathematician, Hermann Weyl, wrote on symmetry:
Symmetry establishes a ridiculous and wonderful cousinship between objects, phenomena and theories outwardly unrelated: terrestrial magnetism, women's veils, polarised light, natural selection, the theory of groups, invariants and transformations, the work habits of bees in the hive, the structure of space, vase designs, quantum physics, scarabs, flower petals, x-ray interference patterns, cell division in sea urchins, equilibrium positions of crystals, Romanesque cathedrals, snowflakes, music, the theory of relativity.



Manchild

Mathematics can investigate pattern and structure underlying apparently diverse 'objects, phenomena and theories'. The successful analysis and elaboration of the logic and diversity of these common patterns and structures leads to wide applications, and to what E Wigner called 'the unreasonable success of mathematics in the physical sciences'.

The imaginative role of Mathematics is also to bring new ideas and concepts out of the dark, to reveal new shapes, patterns and structures. The practitioners of Mathematics are not content to leave ideas in their current state and form. Exactly the same thing can be said of the artist.

One purpose of communication in Art is in giving a 'foothold to emotions'. Where then is the role in Mathematics of hopes, ideals, values, emotions? An answer must have something to do with the notions of truth, of validity, of explanation, which are at their clearest, most rigorous, and most tested, in Mathematics, with its deep and vigorous study of the patterns and structure of logic and argument. The role of hope is in the expectation of understanding, and of discovery. The role of value is shown in our choice of what to study, of what is interesting, and this will depend both on an individual's make-up and on his background culture.

It is certain that the urge to explore and describe pattern and structure has occurred from the earliest known times, and must have been connected with survival, with an ability to map, understand and utilise the environment. Thus the kinship between the Arts and Mathematics is part of what scientists call evolution and the Buddhists call the *Dance of Life*.

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JR: I was watching a live television interview of Max Ernst, in which he said:

You can use your eyes in two ways, to look outwards at the real world, or close them and look inwards into the mind. I think you should open one eye and look outwards, and close the other to look inwards. This way you can see the world objectively and subjectively at the same time.

I like to think this is exactly what I am also trying to do.

Art and Science go hand in hand, and as Leonardo da Vinci, the greatest Scientist-Artist of all time, has stated, *Let no one read me who is not a mathematician*, a statement that appeals to Artists and Mathematicians.

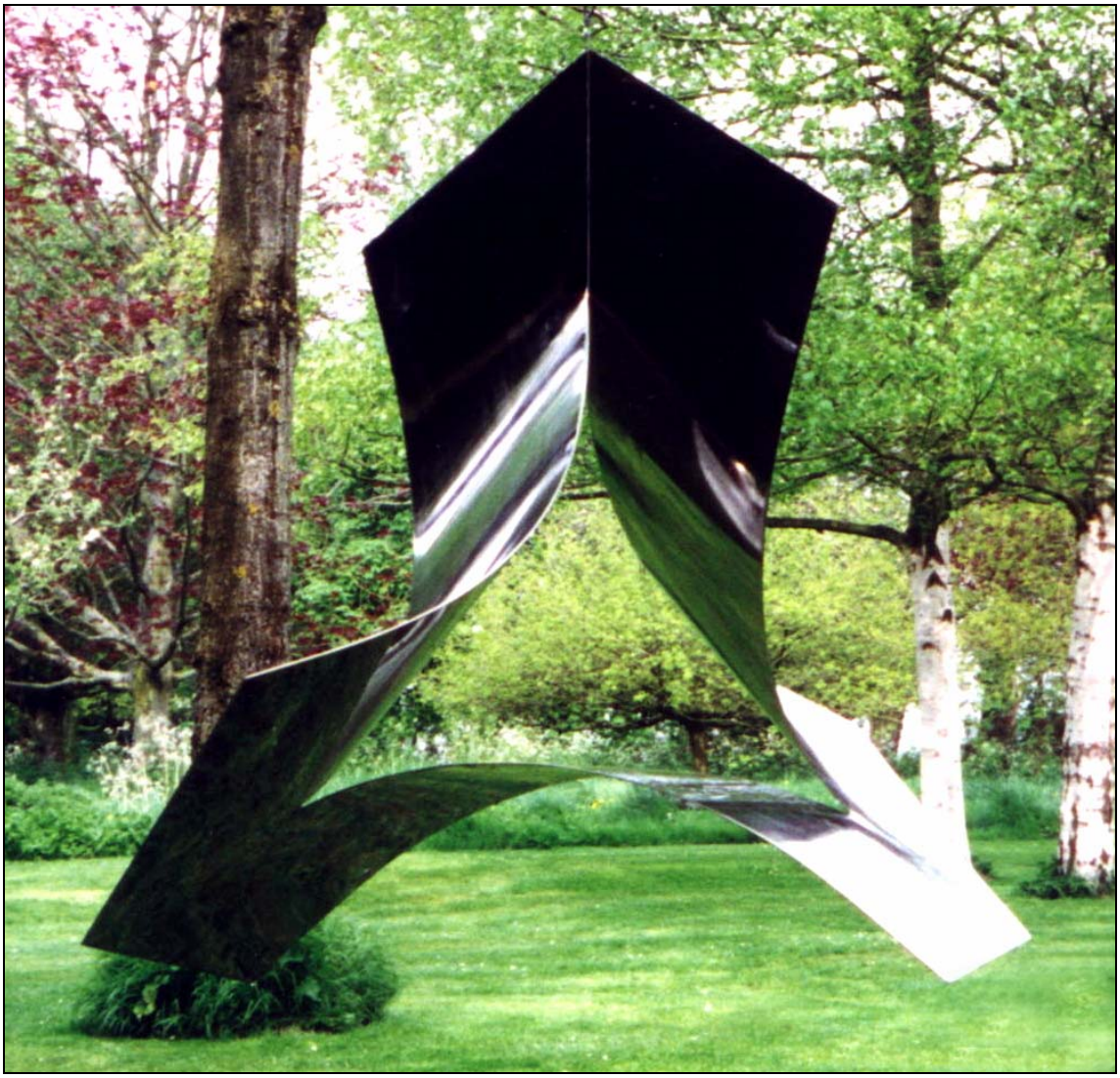
In conclusion I would like to state how I feel about my life as an Artist with a quote from Jung. This is how he summed up his own life and work in *Memories, Dreams, Reflections.*

I know only that I was born and exist, and it seems to me that I have been carried along, I exist on the foundation of something I do not know. In spite of all uncertainties, I feel a solidity underlying all existence and a continuity in my mode of being.

On returning to England to try my hand at sculpture, I went to see my mother, to talk about my decision. She said, "I am not surprised. Do you remember my giving you a set of chisels when you were 12? It was because a fortune-teller told me that you would be a sculptor."

It seems to me that I also have been carried along in a *Vortex of Ecstasy*!

Vortex of Ecstasy



Journey

Damon de Laszlo family expedition team to Mt Agnes

1989

Robert, John, Sam, Damon, William, Pat, Charlie, Lucy and Margie