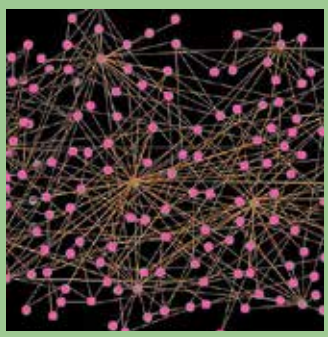
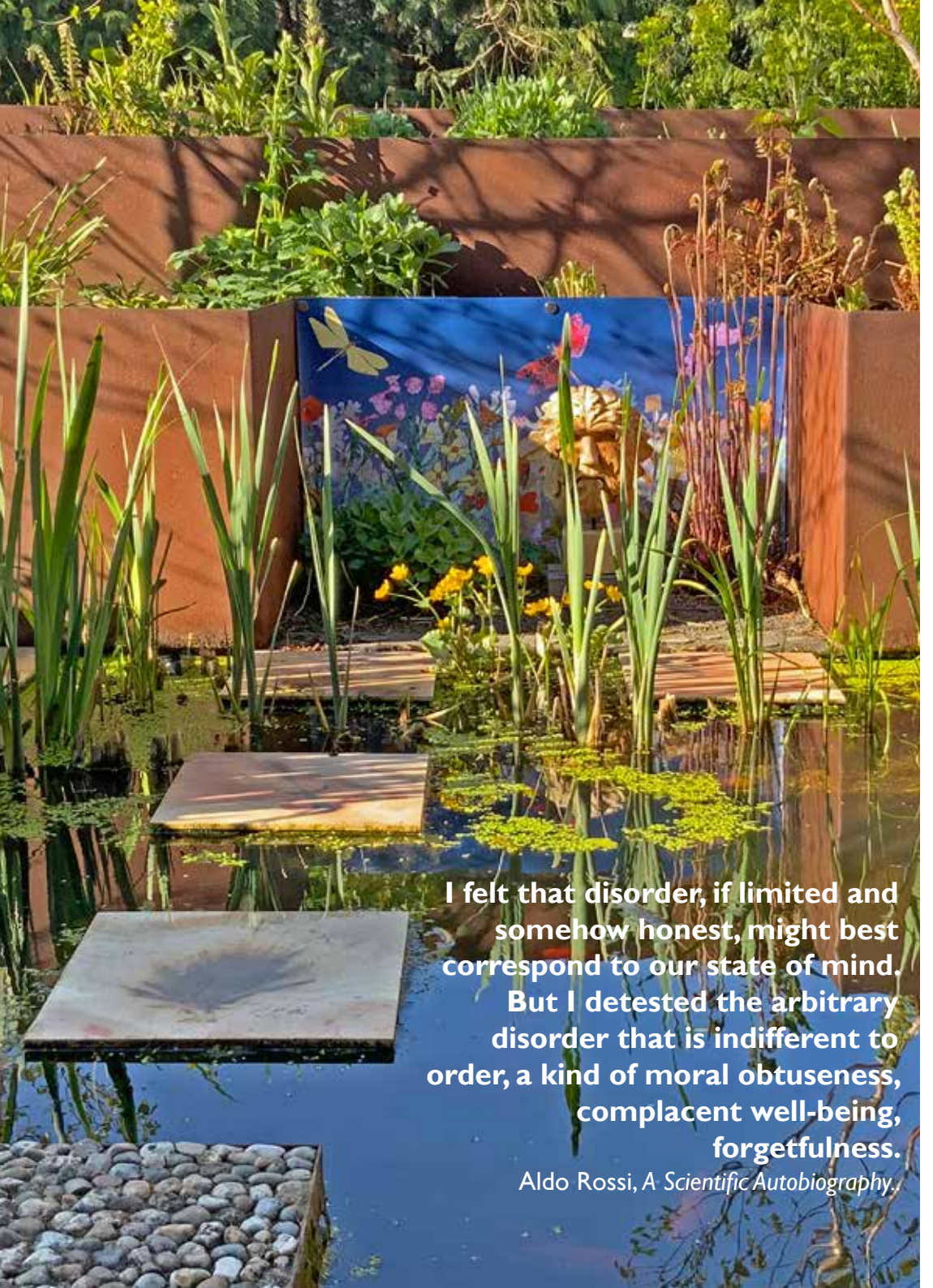
THINKING ARCHITECTURALLY



Real places and digital spaces

Richard Weston



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Deucalion Press

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As an architect you cannot change the world, but you can set it an example.

Alvar Aalto

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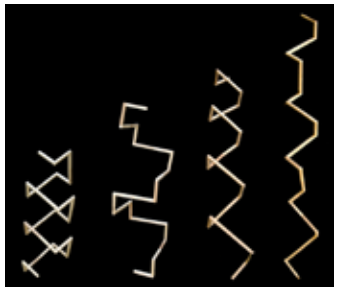
Preface

As a young child I showed an early love of 'making' rather than reading, and at the age of five my father bought me a large Meccano set. From then until the age of fourteen I read almost nothing outside school, save for the Bible (my parents were evangelical Christians), and spent all my time making things with Meccano and balsa wood, electronic components and a soldering iron, paper and paints (I loved colour but had little aptitude for drawing).

When I discovered that a course in architecture would enable me to continue my love of model-making I decided to explore further. I spent a few days sitting in the garden reading Sir Banister Fletcher's vast *History of Architecture on the Comparative Method* from cover to cover. And, in a thankfully shorter, history of modern architecture I discovered the work of Le Corbusier. I duly saved up to buy his book *My Work*, an intensely personal summary of a lifetime's devotion to architecture, painting and sculpure.

A whole world opened up, and although Corbu's name was to become a byword for the supposed ills of modern architecture, for me he remains the greatest architect ever to pick up a tee-square. After becoming the most persuasive advocate of a new 'Machine Age', he rediscovered his early love of nature born from a childhood in the Swiss Jura, and an Art Novueau-inspired education deeply marked by the ideas of John Ruskin.

Such was my precocious passion for Le Corbusier, I was quickly nicknamed 'Corb' at university. The first year at Manchester was run by a remarkable Iranian exile, Esmail Baniassad (known as 'Bani'): his ideas were formative. The second project asked us to make a component that together with other identical components would generate a three-dimensional structure. Having done three A' levels in maths it seemed to me that the quintessence of three-dimensionality were the x, y and z co-ordinates, represented as three sides of a cube (left). Made with square-sectioned balsa, these could join to each other in four systematic ways: they turned out to generate four different, unending helical structures.



Top: 3D component
Above: helical structures generated by systematic repetition.

Having completed the project by Thursday afternoon, I was sitting wondering if it was finished, when a graphic design tutor came round. While he liked what I had done, he said that there was 'nothing of you in it' and suggested I play with my components more freely, like a sculptor. When Bani toured the studio in the early evening, I explained my project and told him what the other tutor had said. 'Don't listen to him, he's a fool,' came the startling reply. 'This is wonderful. You can submit it on Monday and spend the rest of the time reading.' He later told me that mine was the best response to the project over the several years he had run it.

I relate this story, not out of pride, but because I grasped that – as Le Corbusier told an audience of students in 1937 – 'architecture is organisation. You are an organiser, not a drawing-board artist'.

After graduating from Manchester I won a Thouron Award to study landscape architecture at the University of Pennsylvania under the pioneer of ecological design, Ian McHarg. Defining the landscape architect as 'nature's spokesman in man's world', McHarg encouraged us to see design not as the imposition of ideas on nature, but formulating them in response to a deep understanding of a site and the needs of all its occupants, human and otherwise.

I spent most of my 'normal' career in education, retiring early from the Chair of Architecture at Cardiff University at the age of sixty in 2013. During those thirty years I taught modern history and design, read and travelled, wrote fifteen books and numerous articles, and made occasional forays into practice.

Decisive among the travels were visits to Finland, each summer between 1987 and 1992, on which I acted as guide to a tour of Alvar Aalto's work. For most participants, the opportunity to gain access to the still privately-owned Villa Mairea was the highlight. For me it proved a revelation. Aalto was the leading second-generation exponent of the so-called International Style of architecture, but no sooner had he built one of its major monuments, Paimio Sanatorium (1928-33), than he began to question what he called a 'rootless modern architecture', and sought to integrate his work into the Finnish landscape and culture.

The Villa Mairea was the most intense expression of this aspiration, its interior developing into the first example of what was to become known as Aalto's 'forest space'. Unlike the so-called 'universal space' of Modernity, the Villa was conceived as an abstraction of the surrounding pine forest, with specific areas – 'places' – defined by columns, clusters of poles, and changes of light and floor finishes. The black-painted steel columns were wrapped in golden rattan: the orthodox interpretation was that this was a way of 'humanising' the steel in a domestic setting. What no one seemed to have noticed – or at least not dared to suggest in writing – was that it turned the columns into vivid images of the surrounding pine trees, whose dark bark was shed to reveal a golden core.

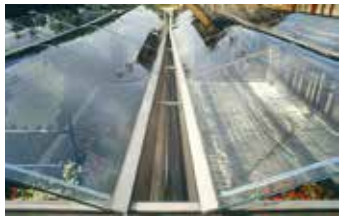
Once the game Aalto was playing became clear, much more made sense. The columns were paired or tripled, not in response to structural requirements but to suggest the irregular spacing and grouping of trees in a natural forest. Echoed in miniature, vertical poles were placed to screen the entrance and staircase. Outside there was a white 'column' consisting of a vertical and an inclined element. The inclined piece was not needed structurally and Aalto's engineer insisted on its being removed, only for it to be reinstated later at the client's insistence. She clearly understood its part in the 'narrative': it was a twin-stemmed birch tree growing outside the 'pine forest' within, just as they do in nature.

In 1992 I published a monograph about the Villa and, three years later, a comprehensive account of Aalto's work which won the Sir Banister Fletcher Prize and helped to secure my future in the

groves of academe. The encounter with Aalto's work, and his passion for finding inspiration in nature, became central to my thinking.

Permit me to mention briefly three of my 'forays' into practice. The first, in 1992, was a glass roof to cover the sunken courtyard of a house. The courtyard had a brick floor laid on concrete and, on sunny days, absorved so much heat that it was uncomfortable to sit in after work. It also gathered wind-blown leaves and litter, so a glass covering was needed: CAD suggested that with UV excluding laminating films and convection currents induced by the glass, the rising hot air could be vented in summer and retained in winter.

The basic idea for the roof was simple: a series of shallow vaults spanning between trusses whose top members also acted as gutters. But it felt 'mechanical', like a commercial glasshouse system, and it was while flying to a reunion at Penn, held in parallel with the Rio Earth Summit, that the key to improving it occurred like the proverbial flash of a light bulb. Remembering the car trip I made across the USA with a Californian friend, I recalled crossing 'The Great Divide', the line running down through the Rocky Mountains into the Gulf of Mexico, either side of which a raindrop – in theory at least! – ends up in either the Atlantic or Pacific Ocean.



I realised that my 'gutter trusses' needed their own divide, with the smallest possible section at the centre, which broadened and deepened to deal with shear forces at each end. I duly asked Mark Whitby of Whitby Bird, if they would take on such a small project. Mark was happy to help, and introduced me to Mark Lovell as the project designer. The younger Mark was a natural-born engineer: we remain friends and occasional collaborators – with hopes of more...

When Mark explained to the client that if he wished, he could cover the roof with temporary boarding and hold a party on it, I began to think about further possibilities with structural glass. Two years later the opportunity came along to teach at a new school of architecture in Milton Keynes, and to build a house nearby on the site of the new town's 1994 'FutureWorld' exhibition. Mark had by then moved to Oscar Faber and his team worked in the evenings to deliver the working drawings for the house, which was designed and substantially completed in a hectic twelve weeks.

The idea for the house was a literal - perhaps too literal – image of the combination of 'global' and 'local' thinking that preoccupied me at the time I was writing about Aalto. I proposed a brick garden wall (the site was underlain by the Oxford Clay Seams) around the whole site, with an aerofoil-shaped, stressed-skin plywood roof apparently floating above. The roof was to be supported by a 3.6m high structural glass wall facing due south, sheltered by the overhanging roof and by louvres above door height to prevent solar gains in winter, with a shallow clerestorey to the north. The open plan included two enclosed 'cores', and Mark managed to turn everything into a coherent structure. The louvres became a structural 'Vierendeel' girder, suspended from the roof and bolted to the glass

to prevent it from bending. The ceilings of the low cores became stressed-ply skins, bolted down to a hidden reinforced concrete frame, infilled with blockwork and finished with plywood panels.

The result had the calm – may I say 'classical'? – feeling I was after, and was structurally far more highly 'tuned' and ingenious than most of the structure-flaunting 'High Tech' buildings of the time. Eight years later, when I came to enter the competition to design the Grand Egyptian Museum, I asked Mark if we could counterpoint the 230m-square Great Pyramid at Gizeh – a mile from the site – with a limestone dome of similar dimensions. 'Just' came the answer, and the project set in train 'cosmic' thoughts to which I will return.

This short book is the distillation of a lifetime devoted to thinking about architecture as the 'ordering' of space and materials. But in the twenty-first century, 'space' is not only the mysterious 'ether' we inhabit, created by the Big Bang, but the equally pervasive digital space of the 'Web'. And online spaces, it seems to me, are in urgent need of fundamental, *architectural*, reform.

Dominated by vast corporate enterprises dedicated solely to making money, 'social media' have turned into a cruel theatre of surveillance and coercion, with masses of people in thrall to so-called 'influencers', bombarded by targeted advertising, and beset by stalkers and others out to do harm. This in turn is driving ever more rapacious patterns of consumption, which are damaging environmentally and, all too often, divisive socially.

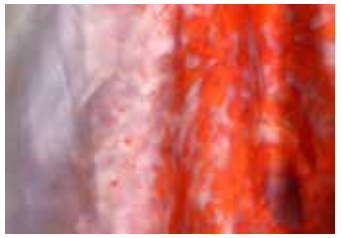
Since my early 'retirement', my studio has been preoccupied with the 'architecture' of the online world, developing tools which I hope merit the description 'convivial' in the sense Ivan Illich wrote about half a century ago. The overall project I call the 'Digital Arts and Crafts', but for the last six years its focus has been on working with children in developing 'Molly's World'.

The book begins with a life-changing adventure into the world of what the political philosopher Jane Bennett calls 'vibrant matter' – minerals, fossils and rocks. This is followed by describing and illustrating how I transformed my own house and front garden using the 'data from nature' I spent countless hours capturing.

Molly's World is then introduced, moving from app and website to the real places of 'MollyCentres'. From this I draw two key themes: working collaboratively 'from the bottom up', *with* people not just *for* them, illustrated with ideas for a National Wildflower Festival and Molly Roadshow; and the urgent need for a new rapprochement between individuals, societies and the other living creatures with which we share Planet Earth.

I hope this book might act as a *rappel à l'ordre*, encouraging many others who are seeking new ways of working that reject the instant gratifications of our fast, hyper-consumerist world, dominated by image over substance, in which buildings spring up overnight like weeds. Architecture, as Frank Lloyd Wright put it, is life taking form. This is slow but urgent work.

From top: ancient Egyptian goddess of the night, name Nut, depicted as a vault of stars sheltering Earth: inspiration for the 230m dome of my Grand Egyptian Musem project (rendering by Galina Lyubimova); digital arts and crafts logo; Molly's World website home page.



Introduction 1
Nature and culture

I first met Richard in the early 1990s on a tour of Finnish Architecture he was leading. In particular I remember our visit to Alvar Aalto's celebrated Villa Mairea, where architecture, art and landscape combined to magical effect. The approach to the house through woodland, the design of the garden, the slender poles screening the staircase that looked like skeletal companions of the trees outside, the pictures on the walls: everything seemed to cohere. And as we slowly explored the site it became clear that it was precisely this synthesis of disparate elements that Richard relished.

Later, as an editor at *The Architects' Journal*, I was able to commission reviews and articles from Richard, knowing that he would write with equal fluency on architecture or landscape, and was sure to look beyond the confines of a single discipline. I was also well-placed to follow his activities as a practitioner, author and teacher, and to understand his deep engagement with 'real places' – seen especially in the innovative house he designed at Milton Keynes and his monographs on such luminaries as Alvar Aalto and Jørn Utzon, where site and setting receive the same fastidious attention as the buildings themselves.

In the commissioning conversations I had with him, Richard could move seamlessly from a classic landscape garden, perhaps William Kent's Rousham, to his latest speculations on the cryptic terrain of Mars, and in the process might well come up with a completely new idea –something that expanded but still reflected his prevailing interests. So although the scarves for Liberty and the app for children, Molly's World, came as a surprise, I knew I should look for continuity more than change in what he was doing.

The digital mineral scans from which the scarves derive are images that a resurrected Ruskin would surely savour – Ruskin has long been a touchstone for Richard– while Molly's World owes a debt to another figure from his student days, the now somewhat forgotten but far-sighted Ivan Illich, with his stress on learning through discovery not inculcation. Moreover the thinking behind Molly's World is not just relevant for children, but prompts all of us to embrace the digital present in the same spirit as Richard, not as numbed consumers but as active creators of a rejuvenated world.

What reinforces the sense of continuity above all, as this book so eloquently explains, is the fact that Richard's digital forays have fostered the design of a very distinctive 'real place'. Over the last few years his home and garden have been filled with prototypes that could have much wider applications, in a realm where outside and inside, nature and culture, truly interpenetrate in a beguiling way.

Andrew Mead

Introduction 2
Paths of infinite creativity

In France, it would be unimaginable for an architect, historian, university professor and eminent connoisseur of modernism, to participate in a talent competition on television. As I delved into Richard Weston's career, it was with great surprise that I learned that he had been one of the lucky finalists in a television competition organised by the fabric brand Liberty. Before the eyes of millions of Britons, in 2011, he introduced designs taken from his superb photographs of minerals, fossils and rocks. So successfully that the following year, these patterns were found on scarves sold at Le Bon Marché in Paris!

No one would have imagined such a fate for these images, not even the person concerned – however my little investigation revealed all. It started in 2003, when he came face to face with an ammonite under the arcades of Cardiff, his city. Because of its nicely dappled surface, the fossil had joined the leaves, feathers and other objects that the architect/historian then collected to subject to meticulous observations. With his digital scanner, he tried to understand its morphological complexity. But with ammonite, the observation proved frustrating: if the device identified the geometry of the details, it struggled to capture the colour of the mudstone and the brilliance of certain crystals. This is how Richard Weston began his long-term visual research. He then acquired the most sophisticated equipment which led him to take thousands of photographs.

Crystalline minerals had never been the ones that interested him the most, he told me. His preference was for agates: almost as much for the mystery their formation in rocks as for the textures and colors which his scanne and microscope could capture. Thus he never tired of observing the subtleties of the forms of nature, nor of finding correlations in the domain of art. A particular specimen of pyrite reminded him of a sketch by the deconstructivist architect Peter Eisenman, another mineral more closely resembled a work by the painter Malevich. He had even isolated several hundred calcite images and attributed them to an artist straight out of his imagination: Carlo Alcite, an obscure master of the 17th century, whose biography he hoped to write one day. The images seduced him through their evocative power.

His photographic project took an unexpected turn after the television competition. This spotlight had transformed the destiny of its mineral landscapes: after this episode, they had colonised scarves, but also umbrellas and phone cases. Images of variscite, moonstone and paesina stone were also applied to construction or decorative products: rugs, slabs and tiles with which he had covered his garden and the floor of his house; draperies that had dressed the curtains and sofa; wall panels or printed glass for larger architectural projects. Then, a new transmutation, the materials, minerals and rocks shifted into virtual reality, courtesy of 'vertical stacks' of images taken by his microscope, and became 'digital paints' for children to colour with.

Richard Weston now spends most of his time developing Molly's World, a digital universe intended to stimulate the creativity of children eight and under. Molly is the name of his previous cat, who, courtesy of a child's drawing has become a cartoon character. She lives with Patch, her dog friend, and a rabbit called Bouncer, in a universe whose atmosphere and setting are defined by touch, from a gallery of options drawn from visual searches. The children's tapping hands make them meow, purr, paint, colour, and explore in all directions this world of pixels. Everything is thought of based on the children's extreme sensitivity to natural motifs and their appetite for making the inhabitants of the place 'alive'. In this cabinet of visual curiosities, children's fingers are invited to discover virtual minerals and fossils, to wander through microscopic landscapes or to design paintings, even to have them printed on mugs, cushions, notebooks, tee-shirts or bags. In Molly's world, creativity is infinite: the virtual intertwines with the real, the infinitely small with the infinitely large, incessantly. From 3D to 2D to 3D to… XD!

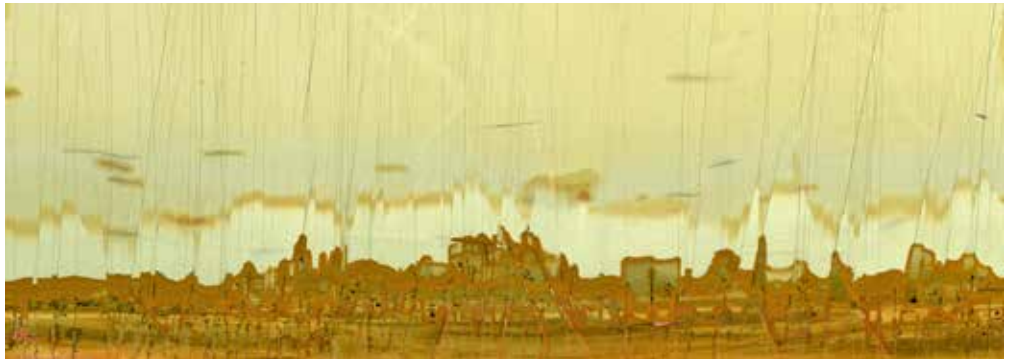
Dr. Béatrice Durand

1. Data from nature

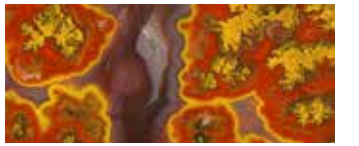
Towards the end of 2003, I was wandering through one of Cardiff's network of small arcades, the most numerous surviving in Europe, and found myself gazing at the window of a shop called 'Crystals'. It mainly sold jewellery and crystals to cater to the burgeoning New Age beliefs in their healing powers, but what caught my eye was a large ammonite fossil priced as at slightly daunting £145.

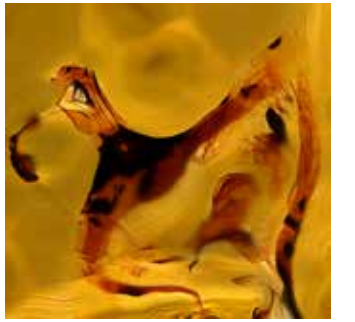
As it happened, I had recently bought a scanner, in preparation for the day, later in the academic year, when digital projectors would replace the beloved Kodak carousel optical kind. I knew that digital images were then a pale shadow of transparencies, flattening out the play of light on materials that I loved to convey to students. That said, I had started enjoying scanning leaves and other natural materials brought back from my rural walks around the village where I lived and was intrigued to know what the scanner might make of the ammonite, and so I took the plunge and bought it. The resulting scan, bewilderingly, was nothing but a muddy brown mess. Quite why the scanner couldn't cope with its polished surface and suble colours I had no idea, but it occurred to me that my scanner was famously the cheapest A3 device on the market.

I did some Googling, and discovered an Epson product, at ten times the price, which was loved by watercolourists for its ability to capture the subtlest of colours. The result was a revelation. Rich earth colours, olives and umbres, were flecked with what I later learnt was golden calcite. I returned to Crystals to buy some mineral specimens and was captivated: the 'Fateful Ammonite', as I came to call it, set me off on years of collecting and scanning. I bought slices of nickel-iron meteorites etched to reveal their mysterious Widmanstätten Lines, costing up to £1,000 for a large specimen. I got to know orbicular and 'plain' jaspers, chrysocolla and charoite, Chinese picture stones and manganese dendrites in limestone (left). At the London dealers Gregory, Botley and Lloyd (founded in the midnineteenth century and sadly sold no longer in existence), I discovered an exquisite material from Italy: known as paesina stone, it bore an uncanny resemblance to the landscape of Tuscany where it was found.



My favourite among these mineral riches, and probably the most widely know, was agate. Strictly speaking, agate is not a mineral in its own right, but a banded form of chalcedony, which in turn is mostly quartz. I soon decided that the science of mineralogy was beyond my grasp, with its pages of chemical formulae and complex atomic structures. I got to know a geologist, Dr Alan Channing, in the School of Earth Sciences, and whenever I enquired how a particularly intricate formation might have arisen, the answer was always the same: 'These things are not well understood'. There isn't even a satifactory theory of how banded agates form, let alone one to account for their more exotic manifestations.





I learnt that the variations of colour in agates, sometimes subtle, sometimes dramatic, could be caused both optically, by the way the light entered into the translucent bands, and was variously refracted or absorbed. Chemically, a molecule in a million could also change the colour. I asked if Alan could find anything in the library on colour in silicate minerals, and he returned with a 500-page volume of conference proceedings filled with long chemical equations...

Although I was intrigued, in an amateur way, by the snippets of science I was picking up, what excited me was the sheer beauty of many of the images. Working away most evenings, to the background of Radio 3 or 4, I spent hours scanning and then eliminating traces of polishing powder which left unsightly white specks. The appeal of the images went beyond the visual: looking at some, they seemed like revelations of the inner order of nature and the universe, while others bore an uncanny resemblance to aerial views of the Earth's surface.

In those early days I had not bothered to explore potential 'design applications'. And then a friend mentioned that some might make very effective interior or fashion fabrics. But the cost of digital printing proved to be very high then: if I was to get anywhere, it would have to be in 'high end' stores such as Liberty, for whom – with its Art Nouveau/Arts and Crafts roots – they seemed ideally made. But the buyers in these stores weren't easily reached (I was later told they often received a hundred or more emails from would-be designers, and simply didn't have time to look through them).

To demonstrate the fashion potential of the 'scans', I decided to run a project called 'Frocks from Rocks' with the nearby fashion design department at Newport School of Art. The results were encouraging, but led nowhere.

And then everything changed. I was listening to the BBC 'Today' programme before going into the university and heard an interview with a man named Ed Burstell. Liberty of London had recruited him from Bergdorf Goodman in New York to head their buying team. 'What,' enquired John Humprhys, 'are you, *an American*, going to do with this quinessentially English store?' The answer was encouraging. 'We're going to try something that has worked well in New York. We call it an "Open Call", and we're going to invite the great British public to bring in ideas for products.'

I registered for the first event in November, 2009, but when the big day arrived the weather was cold and wet, and I had a raging cold. I knew a second 'call' was scheduled for February, emailed my apologies and re-registered for that. Two weeks before, I had a phone call from a tv production company. 'Would I mind being filmed for a series they were producing entitled 'Britain's Next Big Thing' to be presented by the then ubiquitous businessman, Theo Paphitis.

The day came around and I was told not to waste time queuing – the line stretched right around the store. I was then filmed with the accessories buyers and given a card to see the mighty Burstell later, following a chat with Theo Paphitis. Burstell and his assistant were captivated by the scans' potential as large, 140cm scarves. I was asked to come back with samples to meet the buyers. Three weeks later, a film crew arrived at my house, followed by Theo Paphitis in his famous car, fitted with an Air France first class seat so he could work and sleep in it. Its list price was more than the value of my house.

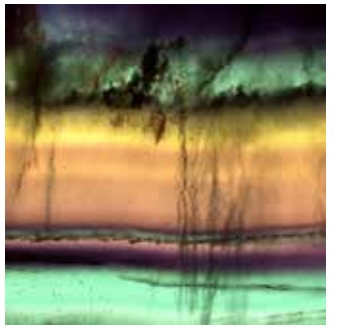
Shortly after I was off with the film crew – at my, not the BBC's expense, I hasten to add! – to Como where the scarves were printed by a firm called Maver. They began life as silk-weavers in the nineteenth-century. When that moved east, they turned to screen-printing. And then, in 1997, they 'went digital', the first in Italy to do so. The quality of their work was superb: they used a traditonal 'star' steamer which, as part of a digital printing process, seemed decidedly 'industrial'. After printing, steaming and washing, the rolls of silk were sent to a nearby 'finishing factory' to be 'stentered'. This involved a machine longer than a cricket pitch that gentlly straightened the warp and weft threads – the key to the luxurious sheen of satin silk.

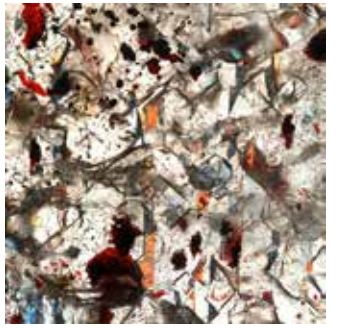
The final process was the most elusive: hand-rolling the edges. At that time, there was only one firm in the UK that offered this, and native Italian sewers were thin on the ground. We went to a small factory outside Como, and at the sight of the camera, most of the workforce disappeared. They were evidently illegal immigrants. A few months later the company folded, and the scarves had to be sent to north Africa to be sewn.

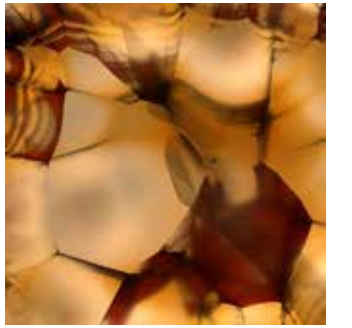
As someone fascinated by the process of making almost anything, I found these details captivating, and I have dwelt on them here because I will return to thoughts about 'making' in the twenty-first century.

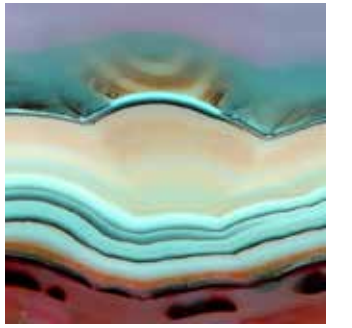
Finally, in the summer of 2010, the scarves were unveiled in Liberty's famous scarf room. They didn't spare in promoting them. Framed scarves lined the entrance, mannequins were draped with them, and I had my own table alongside those of globally famous brands. Later the display became a wall after Burstell moved scarves into the store's atrium. The scarves sold well, second only initially to Liberty's extensive own-brand collections, and all seemed well. But after the third 'season' I began to realise that although I had some 3,000 scanned images, no more than 300 would deliver the relentless novelty demanded by fashion.

Buying new specimens was not a viable option: they were expensive and 'different' ones were increasingly hard to find. The alternative was to manipulate the colours in Photoshop and develop ways of using the scans as paints to create new images. A collection







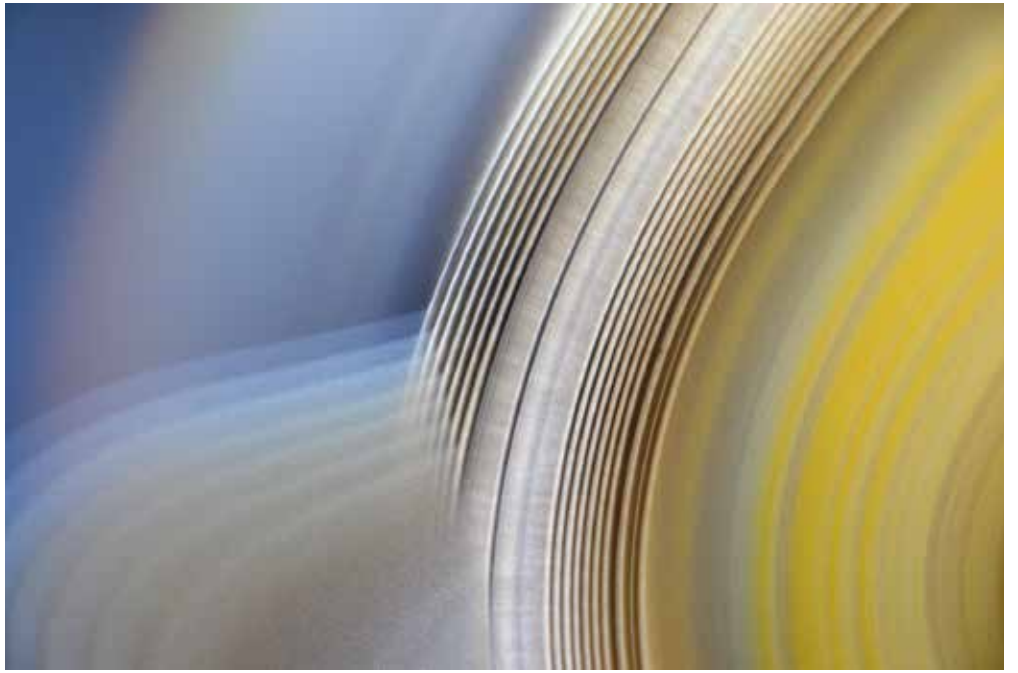


based on trees went down well, but colour-manipulation seemed to offer the best way forward. My business partner took the scarves down that route, but I was too wedded to their 'naturalness' to follow.

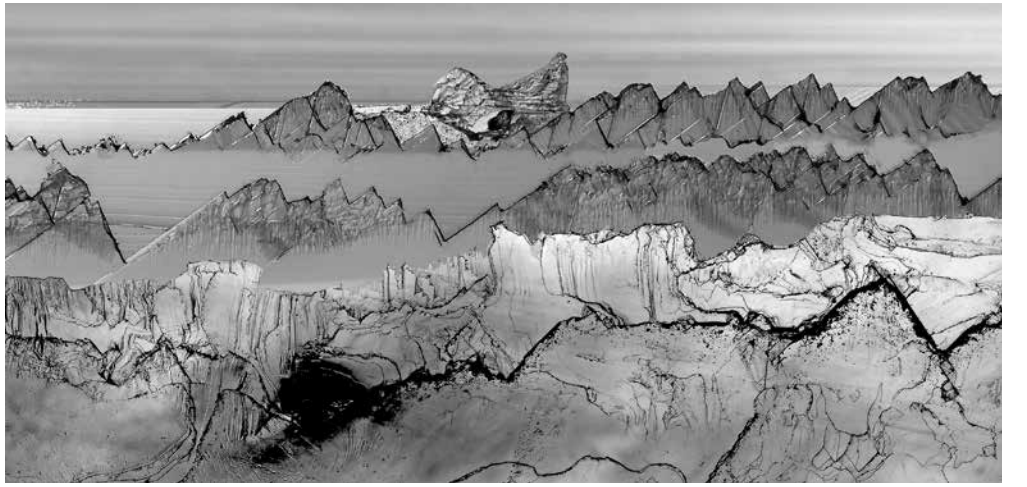
I remember a Chinese Masters student coming into my office for a tutorial. My table was covered with a new delivery of scarves: 'only nature can do that!', she gasped. And she was right. Let me move back in time a little.When I collected the first three fabric prints I took them next door to show a neighour interested in interior design. She wasn't in but her husband, a fireman, said he would love to have a look.

After I laid them out, he said: 'Every one's going to love these, Richard.' Encouraged, I asked him why. 'Look at this one,' he said, picking out a print from an image from an orbicular jasper (left). 'You've got the Cosmos at the top and the beginning of cellular life at the bottom. It's made like us.' His words are etched in my memory, because I believe the key to the hold these mineral images have over me is that they are indeed 'made like us'.

By the time I decided to take early retirement in 2013, I was no longer directly involved in generating a steady flow of scarves, but I was still fascinated by minerals and decided to delve deeper by buying a powerful Nikon optical microscope. Where the most powerful of my scanners offered a 20x optical enlargement, I could now zoom in to 200x. The results were a revelation: I could see that the concentric spherical shells which were the basis of banded agates, were as intricate and varied across a millimetre, as they were to the eye.



The greatest revelation, however, came from calcite rhomboids, one of the many forms in which this most versatile of minerals could crystallise. Although the rhomboids are colourless, they are marked by numerous cracks. I viewed them with transmitted light, and the varying routes the light took through the crystal could generate beautiful colours. Compelling images were hard to find but hugely rewarding, and I have now explored more than a thousand crystals – happily they are abundant and cheap! From these I have two hundred of more that seemed to me like works of art. So I imagined a 'lost' artist born in sevententh-century Genoa, and called him C(arlo) Alcite. His biography and a selection of his work, exquisitely printed in platinum photogravure, appeared in the US fine art magazine *Flint* in 2022. The images have also became a 'world' I called Alciteland on the Molly's World website, of which more later.



Alongside the work with minerals, I had fun exploring a range of other sources of imagery. By far the most interesting was what I came to call a form of 'honorary nature' made by squeezing and mixing small dots of acrylic paints between sheets of glossy paper. The Italian word for 'squeezed' – *strizzate* – seemed more evocative, and so they were named.

The strizzate proved not only to yield additional 'digital paints' for the work with children discussed in the next chapter, but also – under the microscope – a range of potential inhabitants for Alciteland. These most commonly resembled fishes and birds, and the only help they occasionally needed in Photoshop was the slight enlargement of an eye.

One singular individual (left) was so human-like and friendly-looking that I named him Alfonso; he was also one of the few who were clearly visible to the naked eye. Reading, by chance, that clouds could contain algae, fungi and bacteria, I invented 'cloud eaters' (below), Alciteland's equivalent of blue whales – vast creatures able to live by eating massive quantities of minute creatures.

Exploring the history of mineral collecting, I quickly found myself in the mysterious world of 'cabinets of curiosities'. of curiosities. In this context the word 'cabinet' has a double meaning: it could refer to a superbly crafted piece of furniture, inlaid with minerals and fine stones, with tiny cupboards and drawers opening to reveal disparate exhibits. Or it could refer to an entire room, or suite of rooms, such as that shown in this engraving of the cabinet of the celebrated Danish polymath and antiquary, Ole Worm (1588-1644). The collections were divided between natural (*naturalia*) and man-made (*artificialia*), with some blurring of categories when an object's origin was obscure.

Many also featured hybrid objects, made by combining, for example, a branching coral formation with a rounded mineral to make something reminiscent of a creature with antlers. These may well have been at the back of my mind when I thought of 'transplanting' parts of different strizzate in Photoshop and disguising the joints with scarves, snoods and other garments. To me - and to a friend I showed them to - the brought to mind Commedia dell/Arte figures.

Top: Scrovegni Chapel in Padua, decorated by Giotto (photo from Shutterstock).
Above: Detail of pietre dure table-top, probably 19th century (author's collection).

Delving into the world of Renaissance collectors, I also discovered that contemporary books on aesthetics typically devoted more space to the beauty minerals than to paintings. Once you started looking, painted minerals were everywhere, not least in the frames to the scenes in Giotto's frescoes in the Scrovegni Chapel in Padua, one of my favourite places in the world. And of course the colours available to artists then were derived from minerals and stones. Azurite provided the blue for skies, but when it came to representing the Virgin Mary, only the far more expensive lapis lazuli would do. Found in a remote and troubled (nothing changes!) area of Afganistan, it was typically specified in painting contracts that it must be used to represent, for example, Mary's robes.

Among the mineral collectors, none rivalled the Medici. They set up an informal network of 'scouts' around Europe to look out for particulary fine specimens, and founded a workshop - the *Opifice delle Pietre Dure* in Florence - dedicated to the craft of decorative inlays of 'hard stones' or minerals. The Opifice is still active today, training craft workers to restore furniture and buildings; thanks to the foresight of the Medici, they have a stock of several million specimens.

Knowledge of minerals and fossils was part of an aristocratic *lingua franca*, and they posed a serious challenge to their understanding of nature. The discovery on the tops of mountains of shell-like ammonites, so obviously of marine origin, defied explanation. And so too, to those who believed in Nature as the work of a creator God, it was utterly baffling that some of His most exquisite materials like agates, were buried away in moutains until they eventually eroded out and the nodules could be cut open to reveal the splendours within.

I was predisposed to be fascinated by patterns in nature, having been introduced by Bani in my first year at Manchester to the *New Landscape in Art and Science*, a 1956 book edited by the Hungarian exile Gyorgy Kepes shorly after he was asked to found a new discipline of visual studies at MIT. A series of books called 'Vision and Value' followed in the mid 1960s, and in all of them Kepes sought to present natural forms alongside the work of artists, designers and engineers. Aerial views of river systems were compared to electrical discharges, pine cones to the similarly helical forms of many seashells. Having been displaced by the Machine as a presiding metaphor among the first generation of Modernists, Nature was making a comeback through images of analogous processes across various, apparently unconnected, phenomena and scales.

The underlying processes that produced these striking correspondences are remarkably few: nature is parsimonious in her means but infinitely varied in manifesting patterns and forms. Many, of course, appear in minerals and rocks leading, as I mentioned in the Preface, the political philosopher, Jane Bennett, to refer to them as 'vibrant matter'.

She is not alone in seeing something not so very far from life here. The great evolutionary biologist, Ernst Haeckel, whose exquisite drawings of natural forms inspired countless Art Nouveau artists and designers, turned to the study of processes of crystallisation late in life. Startled by what he found, he invoked Goethe's idea of a general morphology of nature. Viewing animals, from an evolutionary point of view, as more complex crystals, he invoked the term 'crystal souls' to describe the quasi-living forms of liquid crystals.

Sadly, despite my work's exposure on 'Britain's Next Big Thing', my passion for minerals was not widely shared among contemporary designers. Two, both friends, did respond: the architects Patel Taylor asked me to supply translucent organza silk, printed with an image from a sea-and-sky agate, to laminate into the glass louvres of a house in Royal College Street, London. It won the Sunday Times's 'Small House of the Year Award' for 2012. And closer to home, a meeting room in the office of a firm of political lobbyists in Cardiff Bay designed by Ongl featured a flourite-filled wall. By then, however, my own house had been turned into a test-bed for digitally printed materials, as we will see in the next chapter.

From top: my house outlined in red (drone picture by Matt Cant); 'Staircase of Curiosities'.

2. House and Garden

In 1999 I moved into a quiet close of eight houses in the village of Dinas Powys, just west of Cardiff. The house was designed by the architect Graham Brooks thirty years earlier. and is the last but one of eight in a very shallow crescent of what estate agents call 'link detached'. The house itself is a refined version of a 'standard British semi', with an open plan ground floor and the normal two bedrooms and a box room above. At just over 2.4 metres the ceilings are far more generous than they would be nowadays, and there is a cloak room in a single-storey wooden box in front of the brick structure.

You enter the house under a flat roof whose beams project to form a trellis resting on a 2.6m high brick wall projecting from the garage/neighbouring house. Entering through a glass door between this box and the house proper, you look through a matching glass panel to the neighbouring house's projecting brick wall. I have described this arrangement in detail, because it encouraged me to take the unusual step of making an elaborate front garden: it enjoys far more sun than the north-east facing back of the house and, thanks to a 900mm drop from the pavement could be exacavated out to form a sunny, private enclave with a large pond.

But I get ahead of myself. The garden was only made in 2015, following early retirement and a healthy 'pension pot' in the bank. Long before that I began experimenting with the interior. The tall ceiling allowed me to insert a shelf to form a continuous 'horizon' around the living-dining room, partly to house my overflowing book collection and partly to display a similarly burgeoning collection of 'curiosities' - minerals, fossils and ceramics. The shelf was replicated below to form storage shelves behind linen-covered panels, which parted in places to allow the shelves to create display niches.

I have always had a love of collecting, mostly bools until I scanned the 'fateful ammonite'. Unable to interest other designer in their potential I set about using them to line the walls, and make interior fabrics, ceramic tiles and digitally woven rugs.

The one lapse in the original design, which Graham Brooks regretted, was the staircase. Originally made of open treads in a dark hardwood it was at odds with the light, Danish-influenced feel of the house. The pension pot was duly deployed again, to create a 'staircase of curiosities' to house most of my minerals in sliding drawers fitted with shallow wooden trays. The 'geological stratification' of the design created more opportunities for display – and for my cats to linger and pose half-way down.

For the linen wall panels I chose an image from paesina stone, a unique form of limestone found in Tuscany, north of Florence. A favourite of the Medici it was widely used to decorate Renaissance cabinets of curiosities. The stone itself underwent a metamorphosis as a result of the collision of the European and African tectonic plates which created the Dolomite mountains further north. Manganese and iron slowly entered along the bedding planes in the limestone, colouring them olive green and brown. Running through this 'landscape' layer is a network of cracks induced by the tectonic forces. They cross the bedding planes, and mark the 'sky' witrh a filigree of ultra-fine lines. Quite apart from the intrinsic beauty of the panels, which I have just extended out into the front and back gardens, having such a beautiful story to introduce to visitors seemed to me an added bonus.

Standing to cook in the kitchen on a vastly magnified piece of Jurassic sea-floor from the north coast of Madagascar added another 'narrative' element. The material from which I captured the image is rich with what geologists call 'ammolites', ammonite-like fossils of diverse species of related creatures. It is cheap enough to use as floor tiles – cheaper in fact than digitally-printed ceramic tiles! – but enlarging it thirty times makes the life with which the sea once teemed vividly apparent.

I experimented with various sources for rugs. A friend (and generous sponsor of this book) bought a very beautiful one made with a 230 million-year-old coral. I eventually settled on one made with the Australian phosphate mineral variscite. Its earthy tones harmonised well with the paesina stone wall linings, although the green streaks have a slightly 'chemical' feel compared with plants: they are the result of trivalent chromium. The mineral itself was discovered in Germany in 1837 and named after the locality of Variscia. My specimen, however, came from Australia.

The founder of the first digital ceramic print-works in the UK asked me to make an eye-catching piece for a trade show and I suggested enlarging a piece of Mexican 'crazy lace agate'. Most agates form as potato-shaped lumps in voids in volcanic rocks, but this 'crazy' version forms in cracks, typically between bedding planes in a sedimantary rock. After the exhibition he offered the tiles to me and I turned them into a wiggly-shaped table with slending 'dancing' legs to ensure lateral stability.

After almost twenty years, the paesina wall linings had begun to fade and I decided to replace them with an image from a new specimen, which two friends, independently, have described as 'visual Bach'. The panels have also been extended out into the front and back gardens: treated with water-resistant spray they should last at least five years.

The play of shadows from a 'Katsura' Japanese maple placed on the terrace against the sliding glass doors is a source of delight on sunny mornings. The doors themselves replaced a very large window, so needed no structural work, and were introduced to open onto the new front garden, to which we will turn after a illustrating the aquarium and cabinet of curiosities-character of my living spaces.

Above: view from dining room into living room, with variscite rug and moonstone curtains.
Right: agate display table and walls lined with linen panels printed with an image from paesina stone Display shelves run around the interior like rock strata, appearing and disappearing, and providing much needed additional bookshelves.
Opposite: aquarium ‘scaped’ by Ritchie Newell with Chinese ‘dragon rocks’ and mysterious tree roots from California. The base is made of planes of rusted mild steel, providing continuity between house and garden.

Slowly but surely, as I created more opportunities to display things large and small, natural and man-made, my house turned into a modern 'cabinet', documented in the detailed plan and section above. As my home is also Molly's home, children will be able to interact with this drawing to find out what things are lurking there.

Right: ceramic inspired by limestone sink holes (bought as a student), filled with sea shells.

Below, top shelf: specimens of serpentinites and Chinese picture stone on the wall; and, from back to front: crane made of a seed pod and wire (bought in South Africa; tiny pot by my friend Geoff Swindell; specimen of bismuth (with four more across the front); rose made by suspending paper petals on a piece of coat hanger for several months in a hot, iron-rich well (a gift after lecturing in Kaiserslauten); various shells; a small Roman vase (4th century AD); glass paperweight; and, at the right hand corner, a small fulgurite, a type of glass made by lightning strikes in desert sand.

Below, bottom shelf: large slice of a banded agate; paesina stone (source of the first set of linen prints); agate-like ceramic container; small Bandalasta Ware beaker (an early type of plastic); mineral bowl; 1950s 'coral reef' encapusulation; specimen of rhodochrosite; calcite rhomboid; tiny agate slice; seashell; copper; Roman glass bowl; fossil seashell.

Front Garden

I come from a family of market gardeners, and although my father had a 'normal' job, he turned his back garden into a highly productive resource, selling vegetables locally and literally thousands of then novel small alpine plants to garden centres. As a boy I longed for a goldfish pond, but back then this would clearly have been unthinkable in a typical surburban front garden, and taken away much needed productive space in the back. And small ponds, as my father rightly pointed out, were often difficult to maintain.

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Armed with my 'pension pot' after retiring early, I decided to fulfil my dream – and in the sunnier *front* garden (1) The 900mm drop from pavement to patio necessaited shallow retaining walls, and structured these with a 'steel cliff' (2), made of interlocking bent plates in a manner reminiscent of an early first year project at architecture school. To the neighbours, the arrival of a small back hoe was worring enough, but when semi-rusted mild steel started appearing, I think they feared the kind of 'monstrosity' all too often associated with the misunderstood profession of architecture.

I chose naturally rusted – and still rusting – steel because I knew it would outlive me, and that it weathers with pleasing variations, unlike the more commonly used, chemically pre-rusted, 'Corten'. The colour of a rich clay soil, thanks to the iron in both, the steel not only seems to me a perfect foil for green plants, but is also a wonderful canvas for the play of light and shadows, and dancing reflections from the gently rippling surface of the pond (5).

The three, diminishing, levels of the 'cliff' peel off at right angles to create a series of shallow terraces rising to the pavement, and the intersections make small 'planting pockets' reminiscent, to my perhaps over-vivid imagination, of the way plants grow – and birds nest – on natural ledges on real cliffs. Succulents feel particularly at home in these miniature 'worlds' (6): I have always loved their geometric quality, and as with cacti, the appearance of their often extravagant flowers is a delight.

Birches have been a favourite tree from childhood and a feeling of enclosure, in what is anyway a quiet close, is provided by single- and multi'-stemmed Himalayan birches (7): in winter, their vivid white bark peels (8) into paper-thin layers, like fragments of quilling. The planting scheme, devised and installed by my RHS

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Gold-winning friend Vickie Wade, is dominated by green foliage (9) rather than flowers, with the latter provided chiefly by marsh marigolds and yellow flag iris (10), whose flowers are exquisite but disappointingly short-lived. They quickly settled in and now threaten to march halfway across the pond every year!

My design professors at Penn, Bob Hanna and Laurie Olin, built one of the most highly regarded landscape design practices in the US. Both trained first as architects, and neither was well versed in plants. But they instilled an understanding of the importance of hard landscape design. I'm not sure what they would make of my intricate patio, (11) but for me its design offered the opportunity to explore many - some might say too many! - ideas that had been building up over the years and discussed earlier in this book.

The layout is controlled by a 400mm square grid, determined by the size of the digitally printed porcelain tiles that are variously laid into it. Squares of pebbles, increasing in size as they retreat from the water, as on a beach, fill much of the area. The orthogonal grid extends across the pond as 'stepping tiles' and is broken by elements of apparent disorder: rhomboids of concrete, in homage

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to my beloved calcite crystals, and circles of glass (12), positioned according to the positions of high-magnitude stars overhead on my birthday. They echo the sky-ref;ecting quality of the water and, in low winter sun, project a constellation of sunspots onto the living room ceiling (13). The pebbled areas are also scattered with jasper tumble stones and shells (14): like the 'brick ammonites' in Radiant House, a they offer a challenge for children to seek out while their parents chat.

I knew that architecture was made possible by the confrontation of a precise form with time and the elements, a confrontation which lasted until the form was destroyed in the process of this combat.

Aldo Rossi, *A Scientific Autobiography.*

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I have been living with, and whenever possible *in*, my garden for six years. I don't think my neighbours are reconciled to its design and one, who professes a dislike of trees, cannot forgive me for the way the larger birches interrupt the view from an informal 'balcony' on the roof of their garage. But combined with the 'mineralisation' of the interior, for me the garden has created a sense of 'dwelling' like nowhere I have lived previously. This is in part because of its obvious visual and acoustic delights: it is a sunny enclave, shielded by plants and animated by the ever-changing sound of water flowing down a 'glass volcano' and splashing into the pond (15). (It was made by my friend Rodney Bender by fusing shards of recycled glass.)

These intended fruits of 'design' are complemented by chance events, such as the arrival of a pair of breeding mallard ducks (16), or opportunities to see close-up the miraculous 'making' of mayflies (17) – ancient as dinosaurs – who eagerly land on light-coloured trousers. A niche in the steel terraces is now filled by a fragment of a meadow drawing made with children in the local primary school: the full file could run the length of a football pitch!

And then there are the more arcane pleasures brought by the mineral images, such as inclusions in 1-2mm wide details of a Moroccan agate that resemble marginal plants rising from the pond margin (18). Or the way the cement below a glass disk rhymes with a mug of soup (19). These go unnoticed by many, hardly surprisingly, because although we live in a world bombarded by visual images of all kinds, our attention span is short and few people concern themselves with 'slower' and more esoteric delights. Experiences cited earlier, such as a previous neighbour who saw the cosmos and beginning of cellular life in an image from an orbicular jasper, convince me that the mineral world I love is directly accessible: a Chinese masters student I once tutored, entered my office and, confronted by a colourful mass of new 'mineral scarves', exclaimed 'only nature can do that!'.

Just as Christianity and Classical thought and art once provided a common culture, in the concluding part of this book about Molly's World, I will argue that we need to educate children to feel part of the natural world, to live with it symbiotically in what I call a new 'ecology of space' (20). And in that, 'architecture', understood in its familliar and widest senses, can play a crucial role.

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3. Molly's World

Alongside the work on my house and garden I experimented with colouring drawings with the 'data from nature'. The results were promising and it occurred to me that it could be ideal for young children, who can draw with greater control than they paint. I discussed the idea with an artist-friend, Ruth McLees, who had extensive experience of running primary school workshops. She suggested Albany Primary, a lively inner city school housed in a large, Edwardian stone building. The first workshop took place in May 2011, and we are still working together: it currently has 430 pupils speaking 46 languages.

The head teacher, Mrs Angela Lepore, liked the idea. The school packed two classes of 7-8 year-olds into one of its large, Edwardian classrooms. The children had clearly been well briefed. The BBC2 series 'Britain's Next Big Thing' had just been broadcast, and a girl at my feet looked up and asked, 'are you really famous?'! I said not really, but I have been on television, which prompted a satisfied nod.

I began the session with a presentation about my beloved cat Molly who had, as they say, 'come with the house'. A boy raised his hand to say ' I think Molly's a lovely cat', and I assured him she was. Paper and pencils were handed out and the children asked to make line drawings of cats, with no shading: the 'fur', I explained, would be

added using a computer. It wasn't practical for the children to do this themselves, and so Ruth and I returned to run another workshop about dogs and rabbits. We began by unfurling a 15m long scroll featuring around a dozen differen 'furred' drawings.

First came several versions of the most captivating of all the drawings. These varied strikingly in character and size. Some were less than the size of a postcard, but this boy had asked for an A3 sheet and all but filled it with a delicate outline. 'Furred' with a black moss agate it made for a striking black and white cat: cartoon Molly was born. In my living room I have a 500mm high print of her on 'Dibond' (a rigid lamination of plastic and aluminium used to print outdoor advertising signs). I look at it every day, and marvel at the way a child, with help from my data from nature, could produce an image which seems to me to capture that mixture of affection and mischievousness which is the essence of domestic cats' appeal.

Many years later I was introduced to Jennifer Burgos, CEO of Eclipse Productions, who specialises in connecting children and corporations: she instantly said 'Molly is the finest cartoon character I've seen for years'. Armed with several fine cat and dog characters

from just two workshop in a perfectly ordinary primary school, I sensed I was on to something.

To complement the cats and dogs I decided I need another pet animal, a rabbit, and also thought it would be worthwhile seeing what they made of the seemingly universal childhood fascination, dinosaurs. The result did not disappoint. The best rabbit I named 'Thumper', which I later discovered was the name of a Disney character, who would not hesitate to protect their rights. Renamed Bouncer, he was destined to join Molly and Patch - in the middle of the group on the previous page. As for dinosaurs, who could wish for a more engaging Tyrannosaurus Rex than that drawn by a boy named Callum? Made in three pieces, his head entered the classroom followed by the body and tail, to the children's delight.

Greatly encouraged by the children's work, I delved into psychological analyses of how young children visualise, and much to my surprise discovered that until cultural conventions take hold, the 'style' of their drawings is much the same world-wide, regardless of national cultures. Young children in Japan tend to be influenced early by the pervasive presence of 'cute' imagery, and Manga comics, but until the age of seven or eight most children, left to their own devices form part of a global community of image making.

I decided to explore a different approach. Asked to draw a flower, most children produce a multi-petalled, daisy-like image. I had the idea of getting a whole class - or more - to collaborate in creating an image of a wildflower meadow. This clearly required a wider repertoire of species, so I asked a student to 'vector trace' a selection of flowers: being primarly a teacher, I had never learnt to use CAD or vector-based software like Adobe Illustrator, and still make my architectural sketch designs using the 'paint' programme, Photoshop.

It happened that a former student, Rebecca Pike, was undertaking a small architectural project at England's largest primary school, Woodside Primary Academy. She approached the headteacher who was keen for the school to get involved. Given their greater computing resources it would be practicable to download a free trial version of Photoshop Elements to enable the children to colour their own drawings, leaving me to compose them into an image of a meadow back in my studio.

Many of the indiviual drawings almost took my breath away. Appropriately enough, I emailed the version of a harebell or Scottish bluebell to a very talented Scottish jeweller, Judith Mackay Solanki (one of only four people to contact me as a result of 'Britain's Next Big Thing'), and she replied by saying that it sent her to her book of Charles Rennie Mackintosh's famous flower drawings - and that she wasn't sure which she preferred! Purely by luck, the child had chosen a similar colour to the actual flower - we left them entirely free to choose whichever 'mineral paint' they liked. The drawing is, inevitably, not strictly 'accurate', but it has something far more important: life.

Above: field pansy and meadow crane's bill.
Left: harebell or Scottish bluebell.

The resulting 'Walthamstow Meadow' image seemed to me - if I am allowed to say so - magnificent. I immediately had it printed as a scarf, on a delicate fabric consisting of 80% modal (made from beech tree fibres) and 20% silk. I took it to show the buyer I dealt with at Fortnum and Mason and she said she would love to stock it, only to be over-ruled by the head buyer who said it would confuse customers because the 'Weston' brand was based on mineral images.

This response only added to my growing disenchantment with the retail world, convincing me that a way had to be found to enable children anywhere to draw and colour like this. The answer, I was assured, was to an iPad app. Back then, I didn't know what an iPad - released less than three years earlier - or 'app' was. Rather than take the plunge, I decided to continue my experiments with children, this time in the 'CraftyArtBox', an after-school/Saturday enterprise run by the wife of the estate agent in my village.

Again, the results were encouraging: a selection are shown here. At the same time I began to explore the world of websites for children, and wasn't impressed with what I found. Slowly, the idea of Molly's World began to form in my mind and I contacted a young, Cardiff-based coder, Joe Offside, who assured me he could code both

the 'MollyApp' and website.

Not having had children of my own, the only experiences I could draw on in thinking about how to structure a website for children were with those of friends. One such, twenty years earlier, was still lodged firmly in my memory. I was visiting my oldest friend from school days and he suggested we visit a small exhibition of the work of Anthony Gross, arguably the most important British exponent of etching. Entering the gallery, the work shown to the right grabbed my attention. I didn't need to look closely - from a distance it brought to mind 'cosmic' images that were then beginning to stream down from the Hubble Space Telescope. As there were only a few minutes left before the gallery closed, I asked the assistant to pack it for me while we looked at the rest of the work.

Arriving back at my friend's house, his daughters - then aged seven and nine, I think - insisted on looking at my purchase. It was duly unpacked and leant against the wall. They sat down and began to scrutinise it from all of a foot away. 'Sarah, there's one of those flies that can walk on water here.' 'Elizabeth, there are lots of tiny fishes over here.' And so on, as detail after detail was discovered. What I had taken to be 'cosmic clouds' were in fact weeds floating on a small area of a stream. A fisherman's line and float were clear, as were crayfish and a host of other telling details.

Young children, I realised, engage the world visually and close-up. They have no eye for composition, and images come before words - a key maxim, I later discovered, of the 17th century founder of modern education and author of what became, long after his death, the best-selling children's book of all time. *Orbis Pictus* ('The World in Pictures', as it became known), consisted of hundreds of everyday scenes with all the elements labelled in the vernacular and Latin.

Orbis Sensualium Pictus,

A World of Things Obvious to the Senses drawn in Pictures.

Invitation. I. Invitatio.

The Master and the Boy. | *Magister & Puer.*

M. Come, Boy, learn to be wise. | M. Veni, Puer, disce sapere.

P. What doth this mean, *to be wise?* | P. Quid hoc est, *Sapere?*

M. To understand rightly. | M. Intelligere recte,

In light of the fact that I didn't discover Comenius until well after the home page of Molly's World (below) was finalised, the parallels are striking. In place of the boy and his 'master', I have as my guides Molly, the know-all cat; Patch, an eager-to-learn puppy; and Bouncer, a rabbit of little brain but, as his name suggests, full of zest for life. And a landscape, filled with engaging details, is set against a cloud and large (rotating) sun.

Everywhere you touch opens to content and children explore Molly's World by sight and touch. The site can be visited at www.mollysworld.org, so I will only mention one or two features. Ranged across the bottom are icons representing human 'institutions': Molly's Home, Studio, Museum, Broadcasting Company, Laboratory, Digital Manufacturing Workshop, online Shop and her Bank, into which parents can by MollyMoney to enable children to order goods made with the MollyApp.

Tapping the various images in the landscape and sky opens up deep sea explration in the tiny MollySub; safaris and city-breaks on the MollyJet; a visit to Antarctica, the subject of one of our ecosystem projects; a jouney into space on the MollyRocket; etc. Samples of what you encounter are shown on the next spread. When I introduced the interface to Peter Trevitt, the former director of

Techniquest, Cardiff's renowned hands-on science centre. Peter now works as an international education consultant and asked me if I knew of anything like the Molly's World interface. When I said I didn't, he replied: 'Neither do I, and if something like it existed, I'm sure I would know about it. I think it could do for children what Apple's introduction of the virtual desktop did for adults.'

I was, needless to say, delighted, especially as several friends had questioned my wisdom in ignoring the conventions of a home page and drop-down menu. To which I always replied that childhood should be valued as a unique and precious phase in its own right, not dominated by conditioning children for later life.

When, in schools, I encountered children learning Microsoft Office it always seemed to me to epitomise how wrong, to my non-expert mind, were so many of the developments in education that, driven by a narrow-minded National Curriculum, were suppressing another of children's most fundamental traits, their creativity. And so, after these illustrations of the learning opportunities in Molly's World, we may turn to the development of the MollyApp.

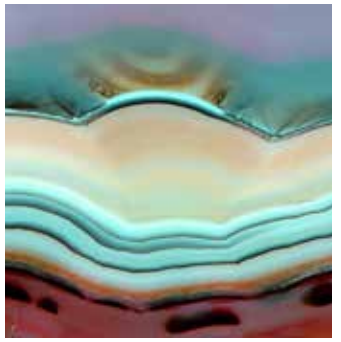
Above: three frames from a swipe-through story, 'Molly meets the chinstraps'. Molly and Patch, as Dibond cutouts, not Photoshopped in, have visited Antarctica twice, courtesy of the glaciologist Dr Alison Banwell, with whom we are working on outreach for children about her research, supported by a grant from the US National Science Foundation.
Right: sub-interface and entry about lions from a 'catalogue' of all forms of life.

Clockwises from top: scene from animated introduction to Cubism, based on Picasso's 'Three Dancers'; part of swipe-through weekend break in Rome; part of swipe-through story about growing wheat and making bread; Patch's balloon - when you tap the balloon on the home page, it roars and take you to a random destination, from where you can choose a related or random link. The landing and random choices never repeat, because the Content Management System records each child's history.

MollyApp

The MollyApp offers tools to draw, colour, make pictorial montages and patterns, and to create animated scenes of stories. Line drawings are coloured with a wide selection of 'digital paints'. These are deried from the database of mineral images and a form of 'honorary nature', made by squeezing artists' quality acrylic paints between sheets of glossy paper. We refer to these by the Italian word 'strizzate' which sounds more atistic than 'squeezed'!

We began testing the first version of the app before Covid. This was coded to work on both iOS and Android platforms, but sadly did not prove sufficiently stable. The iPad is now by far the most ubiquitous tablet in schools and homes, and the app has been re-coded in Apple's 'Swift' language, achieving almost total stability and a much smoother interface. Due to shortage of funds, we have still to re-code the animation tools.



I began the first session with a small after-school club in Evenlode Primary School in Penarth by showing the children this large banded agate, and the scarf scanned from part of it. 'What beautiful colours', came the spontaneous response from all four. The colours are, as you can see, subtle, with not a 'pure' red, yellow or blue among them. For me this gave the lie to the adult assumption, manifest in everything from toys to gawdy play apparatus in parks, that children are primarily attracted to primary colours.

Working with children over many years, with both Photoshop and the app, I have found their choice of colours for different subjects to be both appropriate and keenly observed. The mineral colours have a remarkable ability to work with almost any subject. A perfect example came during our pre-Covid testing. An eight-year-old boy announced that he was going to draw 'junk food' and promptly rattled off the images below, and in less than fifteen minutes. I asked him if he did well in art; he seemed confused, then said 'no, not really'. Quite why not escaped me!

While she was busy working away to create this beautiful 'Easter Bonnet' for Molly, I heard a girl named Amy say under her breath, 'I could live in Molly's World all day'. The junk food and this bonnet alone would have been enough to convince me the app had a future, but there was a lot more to show. I also decided to take the opportunity of testing whether or not, in a market dominated by the likes of Pixar, Disney and Aardman, a simple set of animation tools might have appeal.

I asked a new graduate in animation to make a short story in the style of an early silent movie, complete with grainy texts in ornate borders in place of sound. The story did not hang about. The first frame showed Molly, complete with back pack, climbing a cliff in Alciteland. After less than a second she slid down out of view,

prompting Amy to exclaim 'Oh, no! Will she be alright?!' turning to her, I could see tears falling down her cheeks. I reassured her, and the MollyCopter duly arrived to effect a rescue. Although heavily bandaged, Molly reassured him that her injuries were worse than they looked and she would soon be ready for new adventures.

I was in no doubt that the power of an animation rests less on sophisicated imagery and more on how children identify with the characters. We put the animation onto the children's iPads and some weeks later, asked Amy if she'd viewed it again: 'I watch it every day' she assured me. I talked to the head teacher and he said that no one understands the psychology involved, but that children of 'Mollyable' age (4-8 years) seem to see these characters as being 'alive' in much the same way they might view insects or other forms of life. 'You have a real responsibility with Molly, Richard,' he added, as the children may well follow her advice or example more readily than that of their teachers or parents.

The app has too interfaces, both purely visual like the website. For schools, an imaginary classroom gives access to the drawing and colouring tools by clicking on the jars of pencils and brushes in the foreground. The toucan jungle picture opens the montage functions, and clicking on the wall takes you to pattern-making. Work is stored in the coloured files. For home use, children have the 'digital bedroom' below. This is geared to making real things rather than just images. So, for example, when you click on the mug on the window cill it takes you to a montage format suited to sending to the global

Prodigi digital printing network. The same for the cushion and cards. There are two ways into the pattern tools: the wrapped present on the floor to create gift-wrapping paper, or the wardrobe, where you can choose to create a dress pattern or a tee-shirt. The child's

name appears automatically, taken from the registration details provided by the parents. The room can be personalised in various other ways: the colours of the walls can be changed; Planet Earth can be switched for one of the child's own making; and the view through the window can be changed to the view from the child's real bedroom, by photographing it with the iPad's camera.

While testing the app, children have created a wide range of 'designs' as well as images: digital printing of fabrics is still expensive compared with mass-produced dresses but for birthdays and at

Christmas we are confident that many will run to a special present. The price of mugs, purpose-designed with the app, is comparable with sites offering personalisation via websites. A key feature of the app is that all files are stored in layers, enabling the creator, or anyone else in the world they choose to share it with, to make their own additions or amendments. This opens up the possibility of all manner of collaborations, and in the following chapter I will explore these in some detail.

For now, however, I wish to return to the wider vision for Molly's World, as both an online digital space, and a series of particular places in the real world. I call these MollyCentres, and the first large-scale example was designed for Qatar. This came about when the manufacturers of three inflatable flowers, taken from the Walthamstow Meadow, contacted me. They knew that I had in mind using them both during children's workshops in my home, and to promote the idea of a 'bouncy meadow' play sculpture as part of a planned campaign for wildflowers.

Molly's Middle-East adventure

Little could I have guessed where the inflatable flowers might lead. The makers, the admirably named Studio Soufflé, were approached by a Qatar-based promoter of Expos with whom they had worked previously and asked if they could come up with an idea for a play sculpture for the site of a six-month event in Doha about sustainable horticulture in hot desert climates. They didn't need to think hard!

The meadow quickly turned into an inflatable 'desert', and the organisers, who were closely linked to the Qatari government, asked me if I could organise workshops to introduce Molly's World across their primary schools, and set up a tee-shirt making pop-up to move between the city's vast luxury shopping malls. They also put me in touch with the sustainability division of the Qatar Foundation, which led to a speculative project I called Molly's Desert World.

By the end of September 2023, Molly was all set to be launched in Qatar. I bought two lightweight suits – as it turned out, a few days before the Hamas action against Israel. And so everything came crashing down around me. Although Qatar acted as a mediator in subsequent negotiations, its leader was known to be sympathetic to, and probably funding, Hamas. Quite apart from the potential reputational damage, I withdrew immediately on ethical grounds.

The damage to my projected cash flow was severe, but happily several valuable legacies came from this adventure. The 'Desert World' turned into the sandpit project as part of the Molly Roadshow and, with my former student Phil Coffey of Coffey Architects (one of the UK's most promising 'young' practices - ie the Principal is under fifty years of age!), I prepared a purely hypothetical design for the first 'MollyCentre' (opposite, top). The design for the pop-up in the malls prompted the idea of something similar in Cardiff. And I made the acquaintance of Renee Richer, an American botanist now based at Duke University's campus. Renee has devoted her career to the study of desert plants and had just finished *Hidden Beauty*, an exquisite and exhaustive book about the native and naturalised flora of Qatar,

from which I could select plants for children to draw to create the inflatable desert.

Shortly before the collapse of the venture in Qatar, I thought it would be helpful to have a launch vehicle in the UK, and decided to write to Her Majesty The Queen (Camilla), asking if it might be possible to take children to draw in the beautiful wildflower meadow at Highgrove. Royal approval came almost by return. And so a 'Highgrove Scarf' will be ready by the time we launch Molly's World, alongside this book and our first collaborative project for a National Wildflower Festival, described in the next chapter.

Armed with Her Majesty's support, I approached the Communities team of the firm who manage Cardiff's very large St David's Dewi Sant shopping centre. They were hugely enthusiastic about the idea of a pop-up shop, and so I made the design shown here. Funds are unlikely to be raised in time for this summer's school holidays, but I am confident they will be for 2025. In the mean time there is a good chance we will be able to make a shorter appearance in the run-up to Christmas, with a focus on our work in Antarctica. The final piece in the jigsaw under my control is the design of a 'MollyGarden' to complete the transformation of my house into the first working MollyCentre.

(At the time of wring, this is very much ‘work in progress’. Before the book is printed I aim to have completed significant parts of what is presented here.)

MolllyGarden

My back garden enjoys far less sunshine than the front. I will be able to have breakfast in the sun on the small, newly built, limestone terrace, but for the most part this garden is designed with the needs and interests of children in mind when the house is in use as the smallest of a planned network of ‘MollyCentres’.

The garden has been divided into two: a didactic ‘pleasure garden’ and a ‘secret’ wild garden. A perfectly flat lawn has recently been laid to start the former, and along the north-west facing fence, a paesina stone will extend out from the house, and then from behind that a wooden trellis, stepping down in height half-way along. Roses and other climbers are to be planted in a narrow strip of soil, below which is a steel mesh enclosure for guinea pigs connected to a purpose-made ‘house’ at lawn level (this can be lifted out and brought into the house to ensure the pets enjoy the human presence they love). The three disks comprise of two planet-like images from

orbiscular jasper and a wood-carved Roman sun-god, made by my oldest friend, Stephen Burrows (also responsible for the ‘green man’ and a bust of the prophet Jeremiah in the front garden).

The guinea pigs will play a vital role in the maintenance of the lawn. This will be allowed to be taken over by other grasses and wildflowers, with islands of mown grass. The two larger circles will be defined by a sunken edging and cut with a strimmer, while the circles around exotic plants will be mown/chewed by the guinea pigs in the safety of a temporary mesh enclosure, moved around as required.

At the centre of one of the larger circles is a tiny sunken garden, to be planted, in an inversion of horticultural ‘logic’, with small Alpine plants. This is a miniature fragment of Molly’s Desert World: half of this has been modelled at 1:500 scale and can be installed temporarily as a ‘sandpit of discovery’ on the larger grass circle. The sand will also contain a selection of small mineral specimens, fossils and fulgurites for the children to discover by scooping and filtering the sand into plastic buckets. In our Roadshow, the sandpit

will be used to introduce a range of topics. An easy to use Nikon digital microscope will enable children to see the minerals greatly enlarged, and the sandpit is also a way of introducing archaeology and architecture, geology and sustainability.

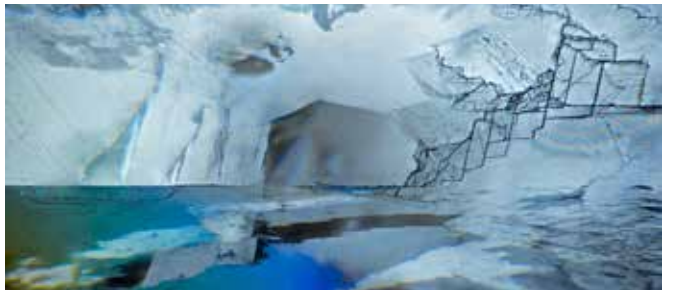
Alternating with the sandpit will be an inflatable igloo and a canvas tepee. On those not infrequent wet but warm days experienced frequently in South Wales, the igloo will provide a waterproof shelter to despatch children out to enjoy working on our ecological 'Pole to Pole Project', while I work with others in the house. The tepee is the representative of a series of projects about indigenous cultures.

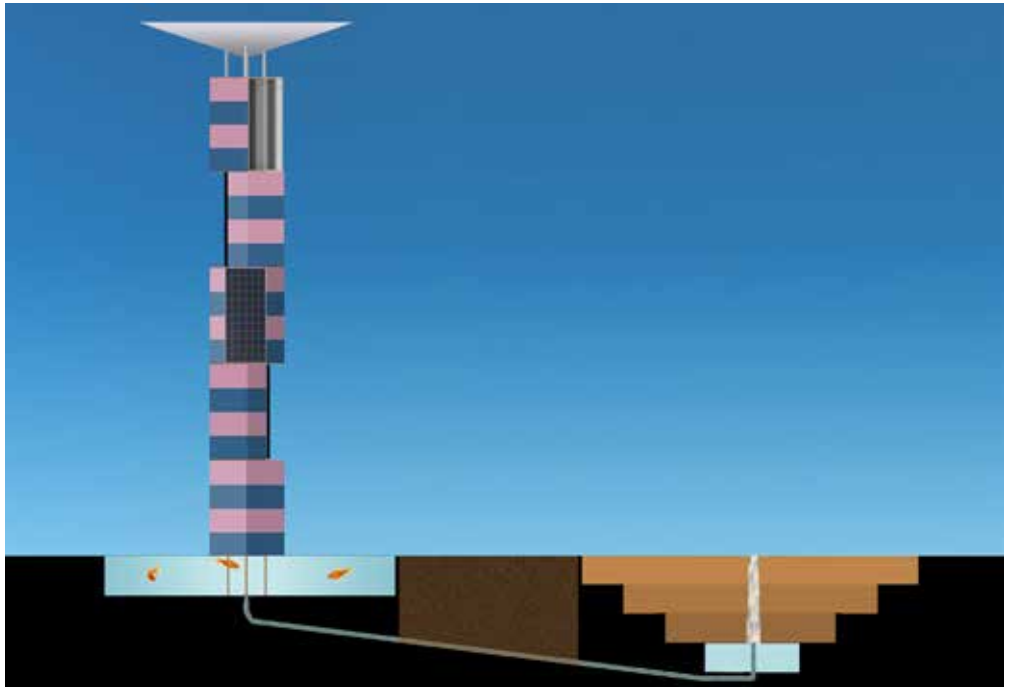
In place of a fence, the end of the garden connects to the sky. It is filled by an agate 'sea and sky' print, against which Patch's Balloon drifts in the distance. A mica-print-sun rises, and in front of this a strizzate bird and 'cloud-eater' fly past. To those unfamiliar with Molly's World, this must sounds like madness. But to children immersed in its many settings and creatures it will be instantly recognisable and reassuringly familiar.

Access around the garden will be via small slate stepping stones, recycled from a previous patio. The two double-square stones to the south-east provide standing room from which to view through two peepholes in the fence (bottom). One, fitted with a 180 degree lens, gives a view into the wild garden which extends out from a small kitchen garden. The other looks into a 'steel grotto'. This purpose-made box on a stilt is already weathering away, ready to be installed. Its ceiling will eventually have an incrustation of selenite crystals, lit from above with waterproof LEDs and treated to prevent them slowly dissolving in moist air (selenite is a form of gypsum and one of very few crystals that are soluble in water or humid air). Lichen are being encouraged to grow on the steel, inside and out, by smearing its surface with yoghurt, a technique used with stone to pre-weather it for use in conservation and restoration work.

The wild garden beyond the dividing fence will be planted with trees and shrubs, attractive to birds, insects, small mammals, and pollinators. In time the planting will be seen above the fence: somewhat like a 'borrowed garden' in traditional Chinese and Japanese gardens, it will hint at a larger world beyond.

The dividing fence also features two bird boxes, in the form of the Molly's Home and Museum icons from the website. When birds are not in residence, children will be able to peep into two tiny catoptric boxes in their lower halves. This seventeenth-century device, lined with mirrors, will create a panoramic vision of 'Alciteland', whose origins were discussed in Chapter 1.





The most eye-catching element in the garden is a MollyColumn. Like a church spire, these will feature in all MollyCentres, large and small, and the version here is a miniature of the triangular 'Tower of the Four Elements' in Molly's Desert World. Two cut-outs house photovoltaic panels, and above them is a Slovenius Rotor, a vertical axis wind turbine. The energy generated from the sun and wind will be used to pump water from a small goldfish pond at the base, in which a few fish from my main pond will go on a summer holiday – it is too shallow for them to face the cold of winter there. Stored in the rain-catcher at the top, the water will be released by a valve operated with a smartphone app to create a short burst of a gravity-fed fountain in the sunken garden.

Unusually, for a garden, I have said little about planting, and the design clearly has nothing to do with the horticultural values that drive the gardens at Chelsea Flower Show. Young children are not contemplative by nature: they enjoy flowers on their own terms, individually, not in artful planting schemes. And they are more attracted by animate living things, bugs and bees, frogs and birds.

As in the front garden with its niches for plants, such as the 'pocket gardens' created by the intersections of the steel cliff, I have created particular settings for exotic plants. Some will grow in containers highlighted by the rings of guinea-pig-mown grass. A pot of hardy cacti is raised for ease of viewing on a section of earthenware drainpipe, and for sweetpeas - native to Sicily and parts of southern Italy - I have designed a conical growing frame fabricated from steel rods and thin stainless steel cable that winds its way up in a gentle helix, in a miniature of a masonry tower in Molly's Desert World.

For children, the MollyGarden will be both a setting for working with the creative iPad 'MollyApp' and a 'collection' of elements that talk about the value of pollinators, the hydrologic cycle, and the physical delights of Molly's World.

For me, the garden is intended to take a tiny place in the long history of narrative gardens that tell stories about our relationships to each other and to the natural world. An extraordinary example was projected in the wake of the French Revolution by a certain Molinos, about whose career I can find nothing. He proposed a circular garden, like a miniature Earth. At its centre was a symmetrical, cross-axial building in the Neo-Classical tradition of Étienne-Louis Boullée and Claude Nicolas Ledoux, and surrounding this was a 'chaos' of winding paths. Inspired by informal English gardens they wander among wild and tamed nature and a living catalogue of world architecture – Greek temples, Chinese pagodas, Gothic pavilions. Just as the Earth had been conjured by the Almighty from chaos, Molinos seems to be saying, so chaos – an order we cannot see – might best represent the world.

Historically, great gardens have always articulated a vision of our relationship to each other and to nature. And it is time for them to do so again. The MollyGarden is playful, as it should be for children, but in my mind it is in the same spirit as the Picturesque gardens which spread out from England across Europe in the eighteenth century. My favourite is the Désert de Retz in France, where the surviving structures include a colourful copper tent; a vast, ruined Doric column, wide enough to accommodate apartments; and a pyramidal ice house that brings to mind Ancient Egypt. We need to reinvent public parks for the 21st century to articulate a new alliance with nature, and to delight our minds and eyes.

ACKNOWLEDGMENTS

Gillian Tordoff, without whose support the book could not be published.

Victoria Wade, for her splendid planting.

Paul Melvin for building it, despite never having worked with steel before.

Rebecca Pike, whose studio drew the steelwork in CAD (which I've never learned to use).

The late Graham Brooks, for designing a lovely close of houses, and providing projecting brick walls to give privacy.

My cats Ellie and Susie for enjoying it so elegantly: seeing them hop effortlessly across the 'stepping stones' is a source of delight!

If you have a garden and a library, you have everything you need.

Marcus Tullius Cicero