BULB MAGAZINE

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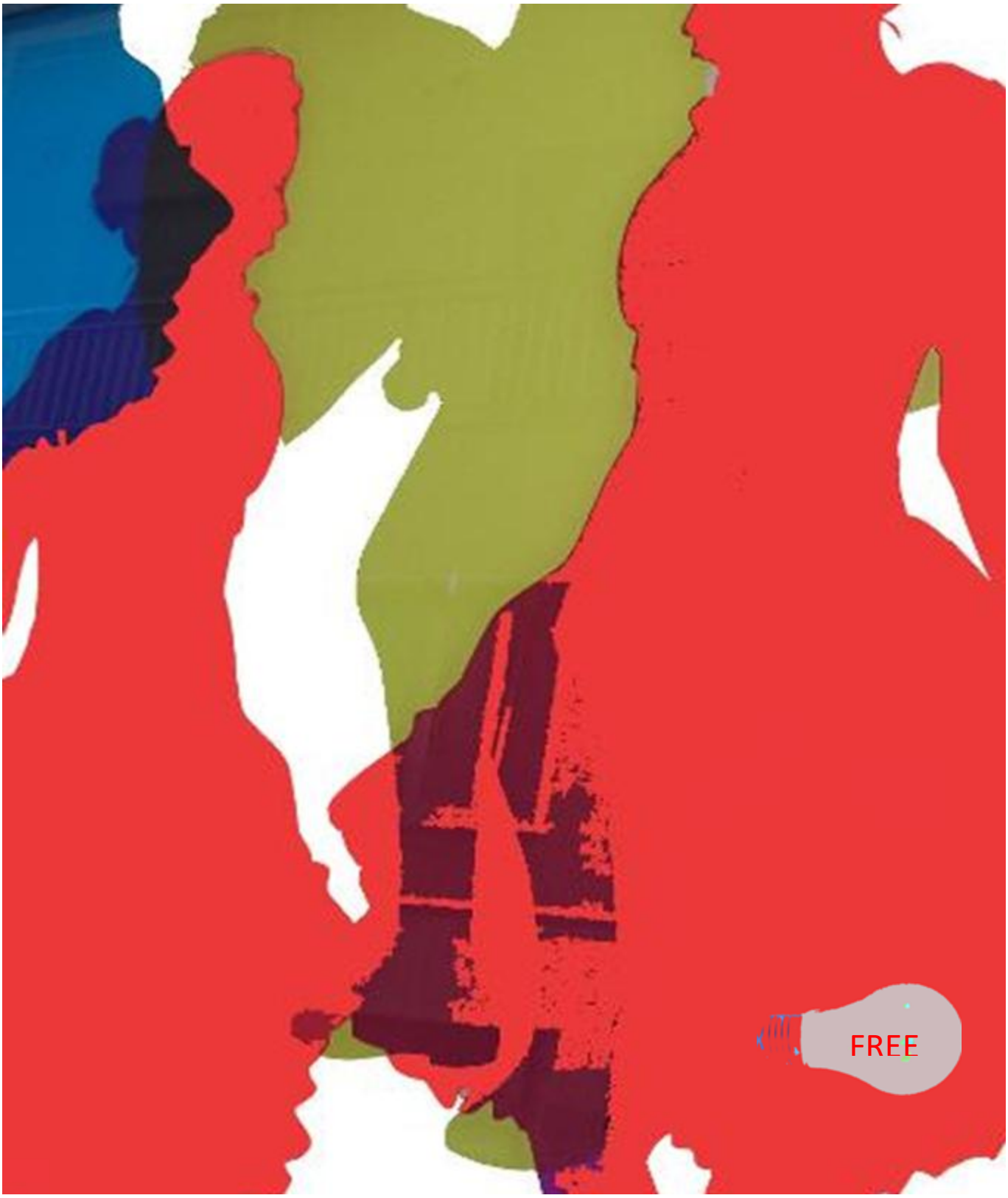

ART, CULTURE, SCIENCE & MORE.....

Welcome to # 4 of **BULB** Magazine. In this issue the content features several items related to women , however, the selection is varied to also include a wider range of reading. In PLATFORM we continue to encourage discussion and debate. We are pleased to include original writing and artwork and would like to thank all our contributors who continue to support the magazine. More at – www.mylastboard.com Contact us at – mylastboard@outlook.com

Cathy Bell (Editor)

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THE MATHEMATICS OF EXPRESSIONIST PAINTING

In 1994 my friend Bob visited me at our new home on the Holy Loch in Western Scotland. A chance conversation established that I was re-reading James Gleick's popular science book "Chaos". Chaos theory was a mathematical discovery which had only emerged once powerful digital computers had become widely available. It established that it was impossible to predict most individual events except in a statistical sense. Since then it's had a huge effect on disciplines as diverse as mathematical modelling, biology, weather forecasting, economics, medicine and engineering. Imagine my surprise when Bob immediately asked if I knew about Lewis Fry Richardson's experiments which involved throwing parsnips which he had grown in his garden off the local pier! It turned out that this chap Richardson had become known as the father of modern weather forecasting. Retiring to Kilmun in the 1940's he had been studying currents in sea to test what became the Richardson fluid dynamics number. Parsnips floated and could be seen at distance through a theodolite and measurements taken of how they diverge from each other. In the course of his studies Richardson had also asked "How long is the coastline of Britain?" The answer that he got was that it depended on the length of the measuring rod that you used! Questioning conventional thinking about measurement of all sorts of things particularly in the then very new science of the very small. What was amazing to me was that where he had lived had been two doors down from our new home!

After Richardson died his work was picked up by Charles Mandelbrot, the man who gave his name to Fractal Geometry. Fractals are Patterns which are generated by repeating calculations in very simple equations over and over again using computers to do the heavy lifting. They directly link to "chaos theory" and indeed are pictorial expressions of it. They occur throughout nature in the branching structure of trees, in cauliflower heads, in mountain ranges etc. Although the original patterns are very regular they never repeat, are very beautiful and enormously complex when generated by computer. In nature however they are exposed to other chance disturbances such as erosion in mountains, and irregular branching in trees. They are at their perhaps most perfect in cauliflowers.

One of the most complex phenomenon in the universe has its roots in the very simple; the flow of liquids and gasses. The next time you look at a waterfall or study the ever changing patterns in the clouds you are privileged to see this. Artists love painting clouds and waterfalls for this reason. Change is everywhere. This is where fractals meet chance and uncertainty. In the case of weather forecasting it makes long term prediction virtually impossible. It's just too complex, but oh so simple at the same time. That is the universe that we live in! Richardson touched on this in his studies in Kilmun. He even tried to apply mathematics to predict why countries went to war. This was a glorious failure. But that was where Mandelbrot was given inspiration posthumously by Richardson. Richardson was trying to measure the lengths of frontiers. Many were man made lines on a map. But the coastline of Britain was not, it was fractal.

And so to art. Perhaps to people involved in crafts, perfection could be considered to have been a sacred goal for millennia. Similarly in much Greek art. Things only changed dramatically with the emergence of impressionist painters in France. And for many painters today this is seldom so. Chance is commonly allowed to play its part. For years people puzzled why they found Jackson Pollock's work so beautiful knowing how he made it by walking about throwing and dribbling paint seemingly randomly in many colours! Now we

know it was a combination of fractal and chance. His gestural body movements produced beautiful art. The fractal component producing satisfying complex patterns, while the random effects stopped us becoming bored when looking for a long time at his work. Much expressionist painting is like this but so is a watercolour wash. Too uniform, boring, too uneven, lack of competence, in the hands of an expert, sublime. But no two washes are alike. It's that expert combination of gesture and very light touch and control when applying the paint. Life studies also betray this. You need a flowing line but one which also expresses the exquisite imperfections that make the human body so fascinating. I have been constantly frustrated by trying to teach amateur painters that by copying pretty details of a larger painting you seldom learn anything. You need to understand the work as a whole and if possible the artist's

(continued)

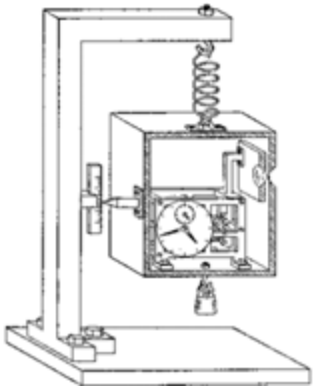
intentions and whole approach to the painting to learn anything. Similarly beginners often try to rework details in their paintings without realising that this means that they have to rework the whole canvas if it is not to look awkward. An exercise that I find fun is to take a photograph of a painting and chop it into fragments. A good painting should yield many pleasing abstract paintings in their own right.

NIELS BOHR AND ALBERT EINSTEIN

The fifth Solvay Conference, named after the Belgian industrialist Ernest Solvay, began in Brussels in September 1927. Present were the leading physicists of the day, including Albert Einstein, Paul Dirac, Niels Bohr, Erwin Schrodinger, Werner Heisenberg and Wolfgang Pauli. The main talking point of the conference was to be the relatively new subject of quantum mechanics and, as such, signalled the continuation of a discussion between Niels Bohr and Albert Einstein regarding the former's theory of complementarity. The Theory of Complementarity states that particles, such as electrons, have pairs of properties that are unable to be measured or observed at the same time. Essentially, this means that if we are able to measure a property such as momentum accurately, then we cannot accurately measure the same particle's position. Einstein did not agree; and as it turned out this would be by no means the last theory of quantum mechanics that he would have problems with despite the fact that Bohr would even use Einstein's own theory of relativity to prove a point related to complementarity. Einstein's problem was one of classical physics, visualisation and causality against the strange, at times weird, theories governing the quantum world. Saying, "there is a good chance this may be the case", was not good enough for Einstein.

In order to prove his point that two quantum measurements could be made accurately at the same time, Einstein came up with a series of 'thought experiments' that he put to Bohr as proof that his theory of complementarity, or Copenhagen interpretation, was flawed. In one experiment (see picture right), Einstein asked Bohr to consider a box which had inside it a clock connected to a small shutter. The box is then filled with photons and weighted. At a known time, a single photon is allowed to escape through the clock activated shutter. The box is then re-weighed and by Einstein's famous equation $E = mc^2$, the exact energy of the photon can be calculated. Thus, the time of release and the energy of the photon have been measured accurately at the same time; in violation of Bohr's complementarity theory and energy-time complimentary pair uncertainty relationship.

Bohr's response the following day, made reference to a box, with clock and shutter inside the box as Einstein had described, but suspended by a spring. On the stand supporting the box, was a pointer and scale to indicate the box's rest or starting position. Finally, a changeable small weight, used to return the box to its starting position when the weight inside the box changed, was suspended from the bottom of the box. Any change in weight could easily, once more, be converted into lost (or gained) energy by Einstein's equation. Bohr's argument was that in trying to adjust the size of the weight the box would be subject to moving up and down before eventually settling, once the correct weight was in place and the pointer was pointing at the rest position. According to Einstein's own Theory of General Relativity, the movement of the box in this way, and therefore the clock, both within a gravitational field, meant that the time measured by the clock in the box was now uncertain in that the clock in the box would measure time more slowly than a clock at rest and within the observer's own reference frame. The longer it takes to get the right weight in position, the worse things get. This meant that to get an accurate measurement for energy, which meant spending a lot of time getting the weight just right, the time of release was now uncertain due to time dilation. Bohr had won round one!



Einstein, however, was still not satisfied with the Copenhagen Interpretation and, by the early 1930's, had come up with more thought experiments with which to disprove Bohr's theory. One such test of the Copenhagen Interpretation was to use experimental information about one particle to then work out properties, such as position and momentum, of another particle. Once again Einstein was out to prove, once and for all, that the inherent properties of quantum uncertainty and unpredictability are only what we appear to see; the reality, for Einstein, was that something, at the moment unknown, was missing, yet once this missing part was found and incorporated into the theory, then the quantum world would fall into line with the classical one.

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Einstein's latest challenge to Bohr was with the collaboration of Boris Podolsky and Nathan Rosen, hence the challenge is known as the EPR Paradox.

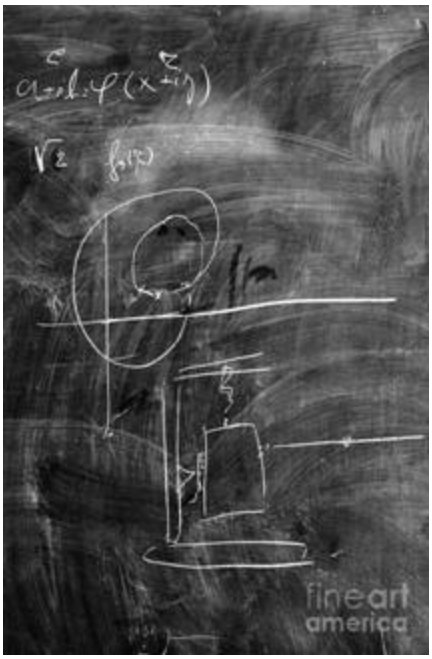
To begin with, imagine two particles that interact with one another before flying off in opposite directions without interacting with anything else. Quantum mechanics allows us to measure the total momentum of the two particles. Since momentum is conserved, this means that at any time later, measuring one particles momentum will automatically give us the momentum of the other. In the same way, measuring the distance between the particles when close together is also allowed, and, in the same way, knowing the position of one we can know the position of the other. If we now measure the first particles position, we will, by the uncertainty principle, interfere with, and therefore not know, the same particles momentum. But the momentum can already be known by having, at the same time, measured the momentum of the second particle. The result is that the position and momentum of the first particle is known at the same time. This was the EPR stance. What the Copenhagen Interpretation said was that because the particles had the same origin, they were connected in such a way that any measurement carried out on one particle is somehow felt by the other; known as 'action at a distance.' The EPR response was that, 'no reasonable definition of reality could be expected to permit this.'

Bohr and Einstein during one of many one-to-one discussions on the subject of quantum mechanics

In the years since, first Einstein's death in 1955, followed 7 years later by Bohr's death, many experimenters have validated Bohr's claims. The term used to describe the connection between two particles that have the same origin is Quantum Entanglement. No matter what the distance is between the two particles they always have to be considered as one entity, in other words one particle cannot undergo a process without affecting the other.

This means that when a property of one particle is measured, say position, this then makes the momentum of the same particle unable to be measured at the same time, it also means that the momentum of the second particle is also disturbed and therefore not able to be used in any way to measure the first particles momentum. The result is that the EPR paradox has failed and Bohr has once again shown that the Copenhagen Interpretation is intact.

Einstein, it seems, never came to terms with the uncertainty and strangeness of quantum mechanics and Bohr, although confident of his Copenhagen Interpretation, was never completely sure that someone somewhere, just like Einstein had done before, would come up with what would prove to be its downfall. Bohr continued to work on problems posed by Einstein right up until his death. His final blackboard (see below), discovered the morning after his death, shows that Bohr was still working on one such challenge.



Finally, one of the best known theoretical experiments, regarding The Copenhagen Interpretation is called Schrodinger's Cat. A cat is sealed in a box with a phial of poison and some radioactive material. The radioactive material decays at random intervals so there is no way of knowing when it will spontaneously decay. The decay is detected by a Geiger counter that will then activate a hammer to break the phial. The experiment was to last one hour and during this time there was no way of knowing the cat's fate. The cat existed in a state of being both alive and dead at the same time. It was only when the box was opened and the cat was observed, that the cat was forced to take one of its two states.

COSPLAY – DAVID HANCOCK

Cosplay can be described as a type of performance art in which "cosplayers" wear costumes to represent a character thus creating an interactive sub-culture based on role-play. Subjects are mostly sourced from Manga cartoons, comic books, video games and live-action films. David Hancock works in watercolour and pencil crayon to create photo-realist portraits of people and characters involved in this complex and increasingly popular activity.

Hancock's engagement with the subject is best explained by the artist himself. Cathy Bell asked him some questions about his work

C.B. Who chooses the pose the characters adopt?

D.H. *The cosplayers generally do. They are based on the poses of the characters they represent. It is a way of getting them into character; re-enacting their mannerisms. In the larger paintings, I ask the cosplayers to find an environment where the character would feel comfortable.*

Advent Children by David Hancock

C.B. In the double portraits are the characters interacting with each other?

D.H. *The characters are from the same text so there is a relationship between them and being paired strengthens their immersion. In Advent Children I positioned the models on either side of a small lake. I try to leave as much white space as possible to suggest how locations and objects drift in and out of the fantasy.*

C.B. Is it only the dressing up that interests you about the sitters or are you interested in them out of character as well? For example, the painting The Down (Siobhan & Courtney) seems to show two women who are not in cosplay costumes.

D.H. *I only depict cosplayers when they are in "cos". In The Down they are in cos: however, the characters are the cosplayers own characters that they have created themselves, which is maybe why they look different from some of the others.*

C.B. Another thing I detect from the work is the gender aspects within it. For example, some of the females are posed kneeling, teetering on the edge and in the case of Resident Evil the girl is shown hiding and terrified under a table. The males on the other hand seem stronger. There are some stronger looking females too and in the case of Advent Children III it is difficult to say whether I am looking at two men, two women or a man and a woman. Is this deliberate?

D.H. *I think this is more to do with the characters. What is interesting about cosplay is that it is so female centric, it is estimated that 80-90% of cosplayers are female. From my research, a large number of females I have interviewed are in a same-sex relationship. For many women, the way female characters are represented in games and sci-fi films is unrepresentative. Cosplay, therefore, allows females to re-imagine the objects of their fandom in their own image, removed from the objectifying male gaze.*

C.B. Do some of the large paintings have deeper meanings than the small portrait heads, for example?

D.H. *Yes, I am able to play with the surface of the paint more. I use the drips to mark the difference between the reality and fantasy in the cosplayer's world.*

C.B. Is it important to you to document the current trend of cosplay?

D.H. *I am interested in how cosplay goes beyond other subcultures in building an identity. Cosplayers are able to take on a whole other persona and "road test" it; literally taking on the characters characteristics and trying them out.*

C.B. I feel the paintings are sociologically relevant to the times. Do you agree and is this what you want from them?

D.H. *What is interesting about cosplay is that it takes archaic practices, such as making costumes and props, and uses these to represent our immersivity into digital platforms. They also bring these interactions back into the actual world, and their primary social interactions are in person, face-to-face. It's almost a seamless merging of the digital and analogue.*

www.david-hancock.com

Ukuhamba isikhathi eside ukuya enkululekweni

LONG WALK TO FREEDOM

- the journey begins

"Good morning ladies and gentlemen and welcome to Oliver Tambo airport"

After nearly 11 hours in the air and 50 years in the making, that wonderful welcome rang out to signal the start of a lifelong dream and an opportunity to experience South Africa for the first time.

As I breathed in the air walking down the steps of the aircraft my heart filled with emotion and as I stepped onto the airfield the tears flowed with such joy and happiness and my head was spinning with excitement. My long journey to South Africa was just about to open up a whole new experience in a country I had dreamed of since a boy.

My journey started when I was 12 years old when my father returned from sailing around the Cape of Good hope and presented me with a gift of 50 Rand to add to my coin collection.

Cape of Good Hope

Little was I to know that the 50 Rand would start a journey which would take half a century to fulfil and now, it seemed like I had awoken from a dream and touched the impossible. Standing in a country with such high hope for the future with a strength and determination to be united, the emotion was overwhelming and I felt I was not visiting for the first time but, I was coming home. A journey to seek the past, embrace the hope and strength of the present and be part of the dreams of the future.

Foreign lands seem so distant when you are 12 years old but my father's stories made me want to learn much more. He spoke of the riches, the diamonds, the people, the culture, the food, the wildlife and the oceans and as he regaled about the view from table top mountain he continued to enthuse and excite. He turned my monochrome images into colour, made the experience alive and in my mind, a dream was forming and an ambition to experience these for myself and then, he introduced me to a new word - apartheid and a new person, **Rolihlahla** or better known as Nelson Mandela.

Nelson Mandela's Cell on Robben Island

He then spoke of the challenges facing South Africa, the separation of their peoples, the rules of apartheid and I began to wonder why?

At 12 years of age what did I know of the world and I certainly could not comprehend the connection between apartheid and Nelson Mandela and as I learned, he had already been in prison 10 years at this point and it would be another 17 years before he would enjoy the freedom we all take for granted and walk again amongst his people and complete his own long walk to freedom.

But my dream had begun so I followed South African life, politics, discussions. I had learned so much of the people, the country and Nelson Mandela I wanted my voice to be heard so in 1988 joined the Nelson Mandela Freedom March at a rally in Glasgow. With my banner and a loud voice *"Free Mandela"* you could feel that change was in the air.

Then at last, On the 11th of February 1990, after 27 years imprisonment, **Nelson Mandela finally Walked to freedom to the sound of his people cheering and in the back ground the music from John Newton's Amazing Grace.**

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"Through many dangers, toils, and snares, I have already come; 'Tis grace hath brought me safe thus far, and grace will lead me home"

Nelson Mandela had come home.

The first place Nelson Mandela visited on being freed was the small humble home he shared with his first wife Evelyn Ntoko Mase, **at** 8115 Vilakazi Street, Orlando West Soweto **.**

Visiting his home was always the centre point of his world and only after release when he returned there, he truly felt free of the prison shackles that incarcerated him. So what better a tribute to the great man than to start our journey where it all began.

Standing in his bedroom, his sitting room and kitchen I felt so humble, but could feel that this was a happy home despite the regime that enslaved many.

It took four trips to South Africa over a period of three years to experience more and to embrace the opportunity to work with and teach the youth of South Africa to help them find their own voice.

"Education is the most powerful weapon you can use to change the world"

This is only the beginning of an exciting journey and in my next part I will look at a beautiful South Africa as one of the most inviting, welcoming countries on the continent with a fascinating wealth of history.

As we follow the long walk to freedom we will travel by road across South Africa, swim with the penguins in Simon's Town, view south Africa from the top of the world and experience a journey of a lifetime.

We will finally look at a piece of art which represents the most exciting journey of them all, the one made by Nelson Mandela, and a tribute to his long walk to freedom.

To Be Continued…….

Puzzle Solutions

Flags:

A Argentina B Botswana

C Egypt D India

E Portugal F Nigeria

G Vietnam H Iceland

Anagram

Canbarra (a); Dickens (e); Rouen (n);

Watt (w); Salvador Dali (l); Hydrogen (h);

Crocodile (i); Carter (e); Mercury (m).

anagram - aenwlhiem

solution - meanwhile

MARILYN AND EDITH

The poet and writer Dame Edith Sitwell was born in 1887 into a late-Victorian world. She was a member of an aristocratic family, her mother being a descendant of the Plantagenets, her father was Sir George Sitwell, 4th Baronet of Renishaw Hall. Edith had an unhappy childhood with little love and affection given by her parents whom she described as being "strangers" to her and vice-versa. Her love-life was no less troublesome, she fell in love first with Siegfried Sassoon the war poet, then later with the Russian artist Pavel Tchelitchew. Since both men were gay so their romantic feelings towards her were never reciprocated, however, both men stayed in her life as friends and supporters of her poetry.

Although not conventionally beautiful, Edith was a striking looking person, at six-feet tall and with strong, angular features she was unconventionally attractive.

Dame Edith Sitwell

Her image was enhanced by her distinctive fashion sense, her unusual, exclusively designed dresses in velvet and brocade were coupled with interesting headgear such as a gold turban and oversized, chunky jewellery. This was a look that, although Edith's take on it was individually her own, other fashionable figures of the period adopted such as the shipping heiress Nancy Cunard. However, Edith was not just a fashion icon, she had a poetic mind which enabled her to experiment with rhythm and word-play thus establishing her as a modern poet of the time. This modernity in her work is perhaps what propelled Edith and her brothers Osbert and Sacheverell to tour the USA doing poetry readings in the late-nineteen-forties. Having established herself there she was subsequently commissioned by Life magazine to go to California to write an article about Hollywood. As a result of this commission, Edith met with the, by then, famous movie actress Marylin Monroe in the Sunset Tower Hotel in Hollywood in 1953. It could be said that the magazine editors were looking to achieve a scoop by putting these two very different women together. Would they get on? Would Edith look down her aristocratic nose at the actress whose roles were often that of an airhead dumb-blonde? Would Marylin find Edith stuffy and out of touch with the modern world? Whatever the case, the two women got on well and, looking at Marylin's profile it is not hard to see why. The dumb-blonde image was only fictional, these stereotypical

Marilyn and Edith at The Sunset Tower Hotel 1953

ideas of beautiful women not being intelligent were, to some extent, a figment of the male dominated movie industries' imagination. Although Marylin (real name Norma Jeane) was born into poverty in Los Angeles in 1926, she became an incredibly successful actress and, after being dissatisfied with her contract, she even founded her own film company in 1954. She then studied method acting with Lee Strasberg. So, although she and Edith came from vastly different worlds and backgrounds, the expectation that they would clash or perhaps have very little in common was proved wrong when they formed a bond – a meeting of minds.

Marylin did have a troubled childhood; being from a poor family she had been placed in foster homes and even in an orphanage as a child. By the same token, although Edith was part of a well-heeled, well-connected family, she felt the same kind of abandonment, this is perhaps something they shared on a personal level. And, far from being an airhead with nothing of interest to discuss with the renowned English poet, Marylin could hold her own in intellectual conversation having been self-taught and an avid consumer of books. It is known that, at Emerson Junior High School, Marylin excelled at writing and contributed to the school magazine. Edith put her poetic talent to use to describe Marylin as she perceived her during their meeting, she said – ***"In repose her face was at moments strangely, prophetically tragic, like the face of a beautiful ghost".*** Judging books by their cover can be misleading and this is one instance where the expectations of those who put these two women together were wrong. Edith and Marylin connected with each other on a human level proving that image and superficial ideas regarding behaviour are irrelevant. The pair enjoyed each other's company enough to meet up again in London in 1957.

A puzzle for Isaac and all his friends who love flags (solutions are on page 8).

A_____

B _____

C_____

D _____

E_____

F _____

G_____

H _____

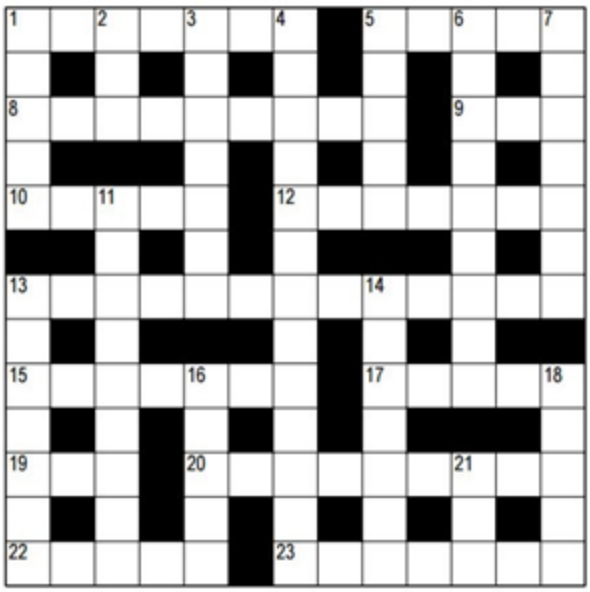
Solve the nine clues below, taking the letter shown in the bracket from each solution. These nine letters will give you a nine letter anagram. Solve the anagram to complete the puzzle.

1. Australian capital _ _ _ _ _ _ _ _ (2)
2. Second name of English 19th century author of 'Bleak House' _ _ _ _ _ _ _ (5)
3. Cathedral city of Normandy, France _ _ _ _ _ (5)
4. Unit of power _ _ _ _ (1)
5. Surrealist Spanish artist from Figueres _ _ _ _ _ _ _ _ / _ _ _ _ (3)
6. Abundant element _ _ _ _ _ _ _ _ (1)
7. Saltwater and Nile are two examples of this large reptile _ _ _ _ _ _ _ _ _ (7)
8. 'Jimmy', 1970's American president _ _ _ _ _ _ (5)
9. Planet nearest the sun _ _ _ _ _ _ _ (1)

Nine letter anagram: _ _ _ _ _ _ _ _ _

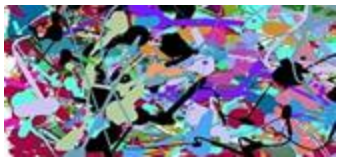
Nine letter word : _ _ _ _ _ _ _ _ _

BULB Crossword No. 4 – Solutions p13



Clues Across:

1. Second city of Sicily (7) 5. Male head of a monastry (5) 8. See Pic



(6,3)

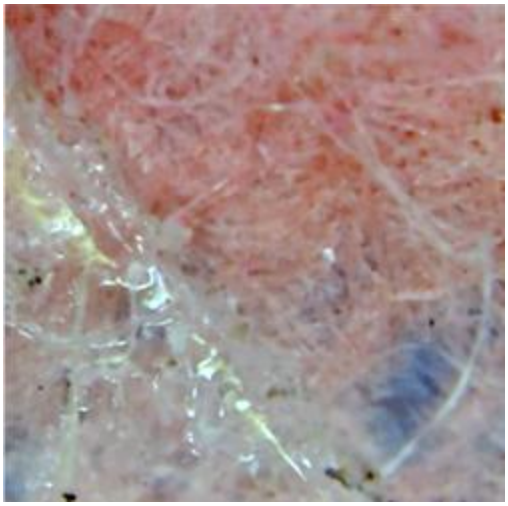
9. His wife became a pillar of salt
10. Bay of Naples island (5)
12. Geological eon (7) 13. South eastern state (5,8)
15. Dark-green silicate (7) 17. Follow behind (5)
19. 'Here' in French (3)
20. Danish-Swedish crime drama (3, 6)
22. Give out steady light (5) 23. Goes with peaks (7)

Clues Down:

1. Amusing person (5) 2. A small amount (3)
3. Largest city of East Anglia (7)
4. Driest place on earth (7,6) 5. Caper (5)
6. Principal dancer (9)
7. Queen of the fairies (Shakespeare) (7)
11. Italian fishing village on Riviera (9)
13. Former Chinese capital (7)
14. Canadian provence (7) 16. Greek letters (5)
18. City of Yorkshire (5) 21. Break ground (3)

We are pleased to present in this issue of Gallery two inspirational young women artists, Hannah Evans and Jorja Scott. Both Hannah and Jorja are talented young artists in the early stages of their creative journey – a journey which is sure to produce work that will bring pleasure to the viewer (as they have already started to indicate with the work shown here). Below are some background details about them.

Hannah Evans has a rare genetic condition that causes learning difficulties and visual impairment. Despite this, at the age of fifteen she is a self-driven, competent artist. Although she can paint representationally she prefers a more abstract approach . She is inspired by lots of artists and from a young age has known what she likes. Favourites are Paul Klee and David Hockney, Picasso, Miro, Hundertwasser, all aboriginal art and the work of Scottish artists like Edgar, Phipps, Cherubini and Williamson. Colour is her world and inspiration. It is as if she lives in a rainbow and radiates joy, enthusiasm and energy. This comes through in her strong sensitivity to subtle colour differences.

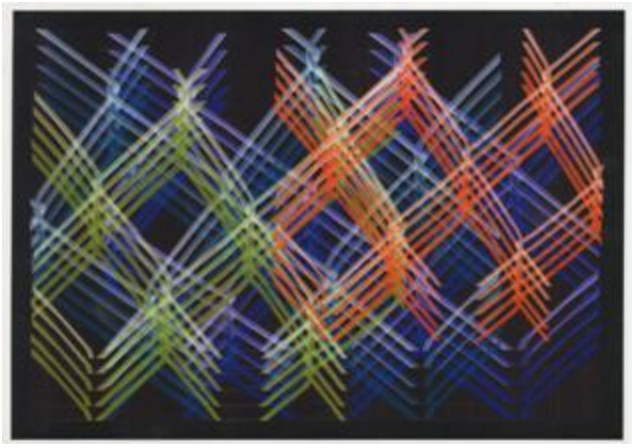


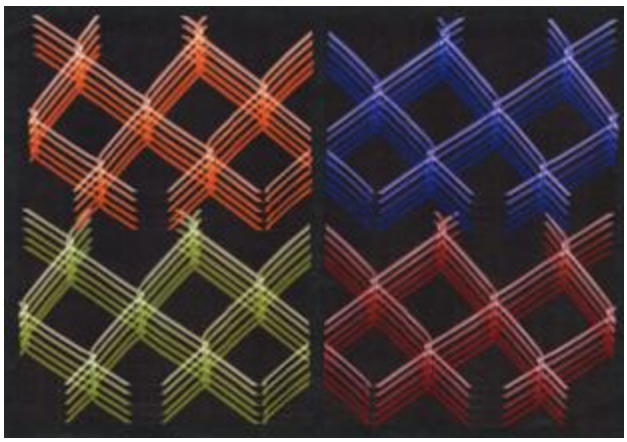
Her rare visual impairment helps Hannah achieve the unique soft focus she wants to create in some of her digital images. Hannah loves experimenting with techniques. She only needs to be shown once or indeed discovers a technique for herself when she goes ahead to confidently apply it. This includes mixing subtle colours, complex mono prints, drip and wet on wet, painting with floor brushes, body parts and throwing paint, melting textiles with a heat gun to make abstract collages and the use of a blow lamp to melt fine silver when making jewellery. Inventions include using dust from a vacuum cleaner in combination with pen drawing to make art and her deliberately "out of focus" digital technique to produce lyrical abstracts where often the only point of focus is the highlights. In her drawing she has developed her own visual language from a young age. She is self-referential, never wanting to be influenced by her peers. Invention is a driving force for her and she therefore never ceases to surprise! Perhaps most important of all she is very decisive and always knows instinctively when something is finished!

I'm **Jorja Scott**, I'm 19 and currently studying Graphic Design at Edinburgh College. During the pandemic I was studying A Level Art in my last year of James Gillespie's High School which turned out to be one of the hardest years I've been through. Art really did help me get through this, I found it comforting and calming when life went downhill as I dedicated and drew most of my artwork for my Nana. Most of my work was based around the impact of having a family member in hospital that I couldn't visit much because of the pandemic and school. The main inspiration for my work was taken from this experience and based on the feeling of trapped and isolated which is why most of it features some sort of metal fencing or geometric patterns that resemble fencing. Pieces also feature images of edited fences that I had created throughout the year and manipulated them to create interesting patterns that show how trapped we were in lockdown. Later this idea evolved into using the fencing images in leaflets, posters, and signs for stroke awareness since it slightly resembled brain pathways and related to the situation with a grandparent in hospital. My final outcome for A Level was a stroke awareness billboard to be placed in hospitals or schools to educate what a stroke is and how to handle it while using the fencing theme to create these "pathways" and help the viewer's eyes across the design.

GALLERY – HANNAH EVANS

GALLERY – JORJA SCOTT





A MINOR INCONVENIENCE

A pool of still water,

Pale yellow reflections

Auguring the presence of street lamps.

In the distance the relentless coo coo cooing

Of collard doves

And pigeons beloved in some back yard.

Tiny pattering feet and a louder, heavier tread

Tell of a dog taking his master for a walk.

Its tiny feet barely ruffle the surface.

The cold drips on her master's trainer

A very minor inconvenience.

A deliveroo driver, too close to the kerb,

Waterfalls his way over the pool.

The result, for the driver, an expletive reaction.

It's a minor inconvenience of the job.

The rainy days give way to summer

People, enjoying the heat, emerge from lock down

And cautiously react once more to the sound of traffic.

The pool dries out.

Leaving only a dip in the road

And the dry cracked surface of a pothole.

Drivers curse as they jolt their way past.

It's a daily inconvenience to them all.

On the other side of the Earth a man sleeps.

His body is emaciated, his swollen belly weighed down

By the burden of no food.

His sightless eyes look out on a cracked landscape from which rain has departed

Perhaps for ever.

It is dotted here and there by crumpled heaps of humanity

Dead. Or waiting to die.

Above him, in the relentless heat scavengers wait.

Fiesta has arrived.

For a short time they will eat, drink and be merry

But when the carnival is over

Their music to will fall silent.

As men and beasts depart,

The Earth will revive, grow green

And support its own re-birth.

If a few carnivores remain to fight and destroy each other

They will be, at worst, a minor inconvenience

The planet, left to itself will survive.

Anne McClintock

Crossword Solutions

Across:

1. Catania 5. Abbot 8. Modern art 9. Lot
10. Capri 12. Archean
13. North Carolina 15. Neolite 17. Trail 19. Ici 20. The Bridge
22. Glows 23. Troughs

Down:

1. Comic 2. Tad 3. Norwich 4. Atacama desert 5. Antic 6. Ballerina
7. Titania 11. Portofino 13. Nanking 14. Ontario 16. Iotas
18. Leeds 21. Dig

MIKHAIL AND ZAKHAR

A BARN IN RUSSIA

ZAKHAR, 17 and MIKHAIL, 18 look out the window to down below. A mob of people surround the barn.

ZAKHAR We have to get out of this.

MIKHAIL Why do you say that?

ZAKHAR Look around.

MIKHAIL How could this happen?

FLASHBACK 10 MINUTES AGO.

Zakhar brushes down Carefree, a black pony. He steals a look across at Mikhail who stacks bales of hay at the far end of the barn. Zakhar is fascinated by Mikhail's stocky body and curly dark hair. Mikhail turns round and catches Zakhar staring.

MIKHAIL What?

Zakhar is embarrassed. He brushes the pony too hard. The pony NEIGHS. Mikhail drops his bale. He comes up to Zakhar. Mikhail takes the brush from Zakhar.

MIKHAIL You're doing it wrong! Here look like this.

Mikhail brushes the pony with long steady strokes. Mikhail pats the pony's neck. He passes the brush back to Zakhar.

MIKHAIL Right you do it.

Zakhar takes the brush and starts to brush the pony. Mikhail firmly places his hand on top of Zakhar's.

MIKHAIL Gently!

Zakhar brushes along the pony with Mikhail's hand on top. Zakhar turns to face Mikhail.

ZAKHAR I..

Mikhail takes Zakhar in his arms and they kiss passionately. The brush drops to the ground. Suddenly an accusing scream is heard.

DARYA Queers!

Mikhail and Zakhar let go each other and turn. A young woman DARYA scowls and marches out of the barn.

ZAKHAR She'll tell! We'll go to prison.

MIKHAIL No she won't.

ZAKHAR She will.

We should run away . Now!

MIKHAIL And go where?

ZAKHAR My neighbour's cousin, he's in America. He has a husband. They're married.

MIKHAIL Shut up. Let me think.

ZAKHAR I'll give her money and ..

SOUND of people SHOUTING.

ZAKHAR I told you she'd tell.

Mikhail quickly takes his shirt off.

ZAKHAR What are you doing?

MIKHAIL Take your shirt off!

ZAKHAR Why?

MIKHAIL Just do it.

END OF FLASHBACK

SOUND of CROWD louder. Mikhail pulls of his T-shirt and is left bare-chested. He helps Zakhar to pull his T-shirt off. Mikhail takes Carefree out of the stall. He throws a saddle over the horse.

MIKHAIL Come on, help me!

Zakhar helps Mikhail to secure the saddle on the horse. Mikhail jumps up into the saddle.

MIKHAIL Come on!

Zakhar jumps up behind him. The CROWD wrench the doors open.

ZAKHAR We'll never get out.

MIKHAIL That's what you think. Watch this!

ZAKHAR Don't!

Mikhail clicks the pony's legs. Carefree slowly trots out of the barn with the two bare-chested young men.

Mikhail raises his hand in a salute.

MIKHAIL Hail Vladmir Putin , our beloved leader!

The crowd part, unsure. The pony gallops off down the field and into the trees. Mikhail stops the pony. He turns and kisses Zakhar.

ZAKHAR Are you happy now?

David Hutchison

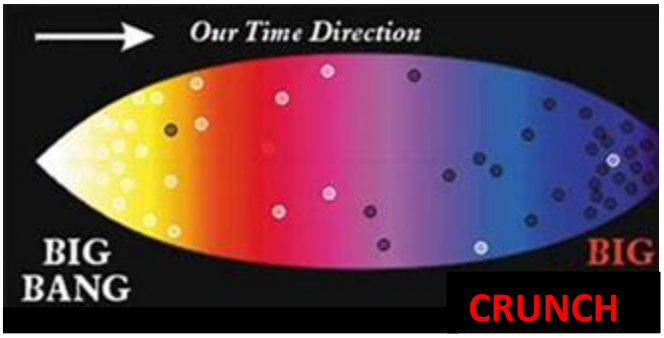
THE END OF EVERYTHING

When Katie Mack says 'everything' she really does mean everything, in as much as what she describes, with quite a bit of humour, is the end of the universe and everything in it. The content, made all the more enjoyable by Mack's own evident enthusiasm for cosmology, includes various theories which attempt to describe how the universe will end. Also included, are descriptions, based on our current understanding, of how the universe works; in some respects, a level of understanding which is still in its infancy. A little quantum mechanics is also thrown in for good effect and alongside references to Star Trek, The Big Bang Theory and Battlestar Galactica, which I far prefer to, people like Carlo Rovelli (another physics writer), who, confusingly for me, quotes the Roman poet Horace at the beginning of each chapter. The overall result is an extremely up to date, entertaining, very readable modern take on the current state of this part of astrophysics.

So, I hear you ask, how will it all end and should we just leave the washing out and not bother about saving for next Christmas? Fortunately, the end is not that soon – or maybe not! Best read on before making a decision about the washing.

Many people are now aware of where, and roughly when, the universe began; as a singularity (a point or area of infinite density) that sort of exploded (The Big Bang) and has been stretching out in all directions for around 13.8 billion years. A word of caution however! Much about the early universe, and indeed the universe today, is open to debate. The reality is no one knows exactly what happened and exactly what is going to happen. Mack is definitely open to such debate and this, in itself, is something which makes you warm to her personality and her style of writing.

Scenario number one is *The Big Crunch*. We'll know well in advance if this is our fate as we will first of all notice that the rate of expansion of the universe is slowing down. This though, will be something we notice well after it has begun, due to the time taken for the light from such far-off objects, such as stars and galaxies, to reach us. This will, however, begin to happen well after the galaxy Andromeda, which is at this moment hurtling towards us, has crashed into the Milky Way; a sort of a small-scale rehearsal for what is to come. Good news is that this 'small' collision between two galaxies it is not expected to affect our own solar system. Bad news is that earth will already have been swallowed up by an expanding, dying sun. Once the expansion of the universe has stopped, the next step is for the universe to begin contracting. Galaxies will get closer, eventually crashing into each other, setting off brilliant light shows for anyone around to watch, and super massive black holes, found at the centre of galaxies, will come together resulting in huge explosions of previously dormant gases, jets of energetic particles and spacetime distorting gravitational waves. And the end? A singularity; and possibly another big bang.

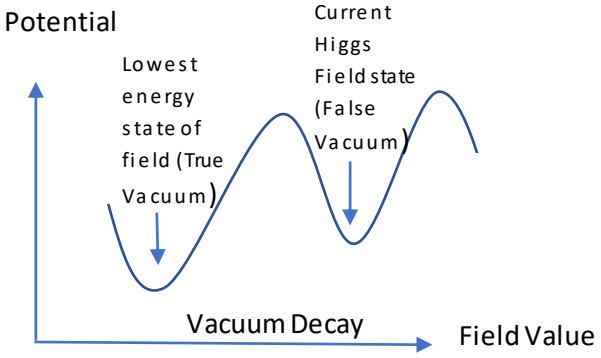


The idea around *Heat Death* is not what it sounds, instead it is about the death of heat or, to put it another way, everything getting colder and colder. To be more accurate, what it really describes is the time when entropy has reached its maximum value – when there are no longer any more sources of heat. The reason that the universe is expanding at an ever-faster rate – the further away an object is in the night sky the faster it is receding away from us – is due to Dark Energy. What Dark Energy is, nobody knows, other than we can't see it and that it appears to have an anti-gravity type effect; pushing matter away as opposed to attracting it. The result is that distances between galaxies and stars are increasing at such an incredible rate, that, one day, when a galaxy dies, it will be utterly alone in the darkness of that part of the universe with nothing nearby to bring in a new source of fuel to bring to life new stars. Stars will burn out and die, black holes will not survive much longer, eventually evaporating to nothingness. Even, in a very long time, the particles that make up matter itself will decay and no longer exist, leaving nothing but emptiness and darkness, no life, nothing.

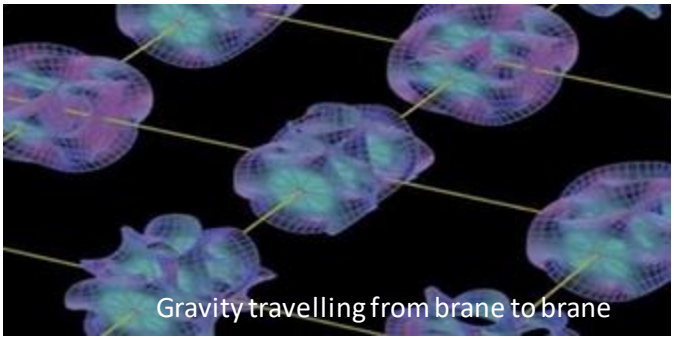
The expansion due to Dark Energy is often described as a sort of cosmological constant that somehow determines the rate of expansion. According to Mack, the cosmological constant has a value. The value, based on the density and pressure of the universe, is -1, a value consistent with an accelerating expansion of the universe. Mack writes that, according to some theories, if the value of the cosmological constant were to change by as little as one part per million, then this would result in dark energy tearing the universe apart. *The Big Rip*, as it is known, will not, for various reasons, become a possible final outcome for at least 100 billion years; by which time everything will already have decayed.

(continued)

The three possibilities above are so far into the future that, although interesting, they should certainly not make us worry. The Earth, if it still existed, which of course it will not, would explode just 1 hour before *The Big Rip*. The next possible outcome, however, could happen at any time. The story begins shortly after the Big Bang itself when previously massless particles interacted with the Higgs Field to obtain mass. The strength of the interaction determining the particles mass. The photon, for example, which does not interact with the Higgs Field, remains massless. The point at which previously massless particles obtained mass is known as the *electroweak symmetry breaking* process. The point at which the Higgs Field sits, giving particles mass and therefore our own existence, is referred to as the *Higgs Vacuum* or *Vacuum State*. The state allows particles to come together to form molecules, structures and chemical processes essential to life. The problem is that the Higgs Field is not exactly where it wants to be. Instead it wants to occupy its lowest possible energy state and, at the moment, physicists belief it is not there. The issue for the Higgs Field, is that it is stuck in a 'hole' and is unable to jump out of the 'hole' into its lower energy state. In effect, the field needs a huge amount of energy in the first place to transition from where it is to its new low energy state. Such energy may come from somewhere in the universe as the result of a massive explosion or the evaporation of a black hole. Although the field may at first be changed only on a local level, its effect would quickly spread producing, "an unstoppable apocalyptic cascade that nothing in the universe could withstand." The result would be the instant decay of all particles with mass. A crumb of comfort, regarding Vacuum Decay, is that if the quantum fluctuations of the early universe during its inflationary period (a time when the universe grew by a huge amount in a fraction of a second, before returning to a slower rate of expansion) and the heat afterwards was not enough to achieve a shift to a lower energy level, then perhaps nothing else can.



The final possibility put forward by Mack has to do with gravity and why it is so weak. How weak? Every time you pick up your cup of tea or coffee (doesn't matter which!) you are overcoming the gravitational attraction of an entire planet. In other words, one thing we know about the force of gravity is that it is very weak - far weaker than the other known forces. One theory is that gravity is somehow leaking. Leaking where you might ask. One theory is that gravity is leaking into another dimension. A dimension (or dimensions) where other universes co-exist with our own. The universes, known as branes, exist, in the main independently of one another, each with its one set of forces governing how things work on each brane.


Gravity travelling from brane to brane

That is, except for gravity, which is able to travel freely across the bulk in which the branes reside, going from brane to brane, universe to universe. The possibility may also exist of gravity in some form, say gravitational waves, being able to carry signals between branes. All very interesting but what is the catch (remember what this book is about!)? The theory goes that what we know as the big bang was in fact a collision between two branes and that such a collision will happen again and again as branes bounce of one another over and over again. If this is true, then we have already had several big bangs and just as many cataclysmic endings and who knows, the next collision could be just round the corner.

Mack concludes with a look at what the future may hold and how we may better understand the universe in which we live. We are learning all the time and along the way we have had to change our view, based on better and more data or simply someone coming along with a better, more persuasive argument. Mack clearly loves what she does and seems to prefer living at a time when we don't have all the answers and we haven't (at the time of writing anyway!) been ripped apart by dark energy. And Mack's last word on the subject? Cool!

Katie Mack is a theoretical cosmologist and Assistant Professor at North Carolina State University. She achieved her PhD from Princeton University in 2009. Her current research includes the investigation of dark matter and vacuum decay. Mack is also a regular contributor to Scientific America.

THE UNFINISHED PALAZZO

The Peggy Guggenheim Collection, Venice

The Unfinished Palazzo tells the story of the three women who inhabited the Palazzo Venier dei Leoni in Venice during the first half of the twentieth-century. The palazzo was known locally as "Il palazzo non finito" due to the fact that the Venier family who began building it suffered a financial set-back during the building project and the plans were aborted in 1780. Nevertheless, there was still enough surviving of the building to be of interest to buyers, not least the waterfront terrace which remained intact and the wonderful view of Venice. So, not surprisingly in 1910 the palazzo was taken over by a wealthy Italian woman, the Marchesa Luisa Casati . The three women to inhabit the building during this period were Luisa, Lady Doris Castlerosse and Peggy Guggenheim, Luisa furnished it with dreams, Doris had it "done up" and Peggy filled it with modern art. The author Judith Mackrell is the dance critic for the Guardian newspaper and this comes across in her tale telling as the narrative displays a kind of forward moving rhythm, a sense of movement and drama that propels it along at a dancing pace. Even though it is a reasonably long book (388 pages) it is never a boring read, there is always so much happening and the lives of each woman are fascinating in different ways.

Starting with Luisa Casati, she was an incredibly rich Italian aristocrat from Milan who became known as a living work of art. It is worth reading this book to enjoy the descriptions of her escapades, her incredible extravagance of appearance and her totally self-absorbed way of seeking the attention of others. Luisa courted the writers and artists of the period such as the Futurist artist Filippo Marinetti and American photographer and artist Man Ray who famously took a strange photograph of her called "The Surrealist Medusa" in 1922. She had many romances and lovers, however, the love of her life seems to have been the Italian writer and aesthete Gabriele D'Annunzio whom she allegedly met while they were out hunting.

Her riding skills had impressed D'Annunzio, seeing her as a "young slender Amazon showing admirable control of her mount as she'd galloped through the "golden bronze" of the Lombardy countryside". It can only be recommended that to discover the incredible story of the life of Luisa and her career as a human work of art, this book needs to be read. Despite such an extraordinary and colourful life, however, she spent her last years living in a tiny flat in Knightsbridge in London. Her wealth had now gone because a Parisian coal-merchant to whom she had owed 29,000 francs was responsible for having her declared bankrupt. Luisa had no conception of money since she had been brought up from birth in privileged circumstances. Even though she was oblivious to reality she lead a fascinating life and often dazzled those around her, especially the Venetian residents who would witness Luisa parade around the city outrageously dressed with her man servant stripped to the waist and painted gold, or riding in a gondola with her pet cheetah.

The Surrealist Madonna by Man Ray (1922)

The next occupant of the palazzo was an English woman called Lady Doris Castlerosse (nee. Delevingne), Doris was the great-aunt of the actress and model Cara Delevingne. To some extent, Doris was only interested in the palazzo as a backdrop for her society parties. She had the reputation as a great seducer and her marriage to Viscount Valentine Castlerosse allowed her the wealth and contacts to live a lavish lifestyle which included the purchase of the palazzo which was actually bought for her by the wealthy American lesbian Margot Flick Hoffman with whom she had an affair. Doris also had an affair with the celebrated photographer Cecil Beaton which was doomed to failure since Beaton was in love with a man called Peter Watson. Nevertheless, Beaton took the best photograph of Doris to appear in the book, taken in the early 1930's, it shows her looking beautiful draped elegantly across a chair. Perhaps the most interesting thing about Doris is that she also had an affair with Winston Churchill just prior to WW2.

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Churchill had set her up in a luxury flat in London where he visited her occasionally. Unfortunately, as with Luisa, Doris spent her final years living in a small flat in London in diminished circumstances.

Doris Castlerosse painted by Winston Churchill

Last but not least to reside in the palazzo was Peggy Guggenheim. Peggy was an American heiress whose father Benjamin Guggenheim was aboard RMS Titanic and was drowned when it sank in 1912. Although the family was rich, it was the case that they were not the richest side of the extended family, Peggy's uncle Solomon, for example, was wealthier and he was responsible for the Solomon Guggenheim Museum in New York which was designed by Frank Lloyd Wright. Peggy seemed to be on a quest to emulate her uncle and indeed surpass him as an art collector. Her life was fascinating with a series of marriages and affairs with such names as the Irish writer Samuel Beckett and the Dutch artist Theo van Doesburg as known lovers, to Marcel Duchamp as a friend and Max Ernst the German surrealist artist as a husband. This is a particularly interesting account of a marriage which distinctly comes across as a marriage of convenience – for Ernst that is. Sadly, Ernst appears to have used Peggy for her money and her contacts in the art world, she was also on hand to help him escape the war in Europe and settle in the US. It would seem that Ernst was not genuinely devoted to Peggy and the marriage ended at his earliest convenience. Another user of Peggy seems to have been the American Abstract Expressionist artist Jackson Pollock who was promoted by Peggy to great effect. He does not seem to have acknowledged her role in his success and, at one point in the book, he is quoted as saying an unkind comment about her physical appearance.

Peggy Guggenheim

Despite all the drama of Peggy's life, not least her difficult relationship with her children, she allowed her passion for modern art to flourish. And, as a testament to the dedication of this collector (and rescuer from the Nazis) of modern art, Il palazzo non finito (even the unfinished bits) is still there for all to see and is now known as the Peggy Guggenheim Collection.

PLATFORM

PLATFORM is an arena where issues can be discussed and debated. These can be scientific, cultural, historical and/or arts related among other ideas. We are looking at these issues from local, national and international perspectives alike.

WHEN IN DOUBT

With the Cambridge's facing descent on their tour of the Caribbean in March, it is clear that the issue of historical slavery has to be addressed and accounted for. As most of us know, people had to remove the statue of the slave trader Edward Colston with their own hands after countless attempts to petition it away were ignored. Also, it was disappointing to discover that the Tate Gallery in London, after consultation with who knows who, decided to allow a mural painted by Rex Whistler in 1927 to remain in their restaurant even though elements of it were deemed as offensive. The panoramic mural entitled *The Expedition in Pursuit of Rare Meats* features a vignette of a Black child being taken from their mother and enslaved. This surely is offensive so why are the people concerned trying to jump through hoops to keep it by having a contemporary piece made to act as a "dialogue" with it and also introducing "interpretive" material to explain it in context? This idea of having a dialogue with a piece like this is pointless, I wonder what can be said of

(continued)

any relevance? Why don't they just remove it?

I am reminded of a visit to Cragside, a large country house in Northumberland, some years ago and being shocked to see an almost life-sized sculpture of a naked Black slave-girl complete with leg manacles standing in a niche at the bottom of a staircase. I was so affected by it that I left a comment asking if it could be removed. Years later in 2020, I sent an email to them asking them if it had been removed. I received a reply in which I was told "while this (the sculpture) is morally problematic for us today – we have a responsibility to accurately and inclusively portray history. However, we know that we need to do better". I was also informed that they would not take objects off display but consider options to ensure that all visitors feel welcome and included. Although I am sympathetic to the dilemma places such as Cragside face in trying to retain the historical aspects related to the house, this is not "doing better" and it is not enough.

I researched this particular sculpture which is called either *A Daughter of* Eve or *American Slave*, it was bought by the wealthy industrialist and arms manufacturer William Armstrong from the 4th Marquess of Hertford, founder of The Wallace Collection. The sculptor was John Bell a highly respected artist of the period whose repertoire included sentimental figures; he often used images of slaves and there was an attempt to, both at the time and even today, perceive this as an anti-slavery statement. The title The Daughter of Eve, according to some interpretations, was intended to convey a belief that all races were equally created by God (but what about the other title it is known by – American Slave)? I don't buy this interpretation and, although this idea was popular in the Victorian era, it is unacceptable to consider slavery as a subject which falls neatly into the category of sentimental thus all of a sudden endowing it with some kind of worthiness. This seems rather like an excuse, no matter how much explaining away about the artist's intentions or the intentions of the owner of the house William Armstrong, this piece is wrong on more than one level. The representative from Cragside told me " there is no disputing that the depiction of the African woman is racially stereotyping, provocative and overly sexualised" However, this aside seems to have been swept away by the fact that Bell was attempting to mimic the classical nudes of ancient Greece and that Victorian attitudes towards women and race were different from the values we have today.

Again, this is not good enough, there are too many grey areas surrounding pieces such as this which was described to me by the person from Cragside as a piece with "a complicated history". I conclude, therefore, that instinct should be the guide rather than intellectual reasoning as to why these unpleasant relics of another age should have a prominent place in the world we inhabit today. My instinct tells me that they should not inhabit spaces where the public might encounter them without expecting to. A more satisfactory solution would be to gather together all these leftovers from the past and place them in a museum exclusively dedicated to this historical nightmare. Here they can be contextualised as they should be and then people can choose to see them if they wish to.

TROUBLE IN 'PHYSICS-LAND'?

A few days ago, early April 2022, Fermilab in Chicago announced that there was a problem with the Standard Model of particle physics. The problem was to do with the mass of a particle. The particle in question is called the W boson, which along with its 'partner' the Z boson is responsible for mediating the weak nuclear interaction. The two bosons are unique in that they have mass, unlike the gluon and photon which mediate the strong interaction and electromagnetic interaction respectively. This is because, unlike the gluon and photon, the bosons interact with the Higgs Field – everything that does this has mass. Once the Higgs Boson was discovered and its mass measured, at 125.35GeV, this gave physicists the opportunity to finally resolve the mass of the two bosons (there are actually three as the W boson exists with two different charges, +e and -e). The W bosons mass was calculated, according to the Higgs mass and Standard Model, at 80,357+/-6 MeV; this was later confirmed by Atlas at the LHC at CERN, with a measurement of 80,370+/-19 MeV – still within the expected tolerance. The Fermilab Tevatron experiments, using quark – anti-quark collisions to produce millions of W bosons, has produced a measurement of 80,433+/-9 MeV. Although the difference is small, it is well outside allowable tolerances and throws the validity of the standard model into question. There are two possibilities. The first is that the standard model is flawed or , secondly, variables that were thought to have little effect are actually far more relevant than was first thought.

So what they thought was true, actually may not be. The moral of the story? We're not as smart as we thought, don't take things for granted or does most of the information that we are bombarded with really matter to our everyday lives?

WOMEN IN SCIENCE

In all of the science pieces I have so far written for this magazine, I have not yet mentioned any women scientists (I have now in this issue - see review of Katie Mack's book). The fact is that women were often actively discouraged from a career in science which, at the time, included universities not awarding women degrees and, more recently, at least two cases of women being overlooked for Nobel prizes in favour of their male colleagues. Below, I look at four remarkable women scientists .

Lise Meitner was born in Vienna in 1878 and educated at The University of Vienna - which had only began admitting full-time women students in 1897. Preferring a career in academia and research she eventually made her way to The Kaiser Wilhelm Institute in Berlin where she would become the first women physics professor in Germany. Her early successes included being partly responsible for the discovery of the radioactive element protactinium in 1919. Later, whilst working alongside Otto Hahn and Fritz Strassman, it was discovered that when the metallic element thorium was bombarded by neutrons, various isotopes were produced (different numbers of neutrons in the atomic nucleus from normal thorium). Meitner continued this work with her nephew Otto Frisch and, in late 1938, formulated the defining theory behind how the splitting of an atom was achieved. This is the process that we know today as atomic fission; and was the process that made the atomic bomb a reality. Meitner was overlooked for the Nobel Prize for the discovery of atomic fission, instead Hahn alone was awarded the prize in 1944. Meitner would eventually be nominated for the Nobel prize, in either chemistry or physics, a total of 48 times – never with any success.

Lise Meitner

By the end of 1938, Meitner, who was Jewish, had moved to Sweden where she continued her work at The Stockholm Institute for Physics and in 1946, she made her way to America to visit Albert Einstein at Princeton; Meitner was well known by all of the notable names from this time, including Schrodinger, Planck, Pauli and Heisenberg (all Nobel Laureates). Meitner retired from the institute in Stockholm in 1960 and moved to Cambridge. Still giving lectures, she continued to be an active part of the scientific community until her death in 1968 at the age of 89. Although never a Nobel Prize winner, in 1997, element 109, Meitnerium, was named in her honour.

Emile du Chatelet

Emile du Chatelet was born in Paris in 1706 into a wealthy French aristocratic family. Because of her background, she was able to receive an excellent education and, from an early age, showed an extraordinary talent for languages, mathematics and physics. Her defining work was the translation, into French, of Newton's Principia Mathematica (published in 1687 on the philosophy of Newtonian Physics and Leibnizian Metaphysics) and the addition of a postulate concerning the conservation of total energy - the postulate concerning kinetic energy and its relationship to mass and velocity. Newton had believed that energy was proportional to mass times velocity (momentum) whereas Chatelet was able to show that energy was actually proportional to mass times velocity squared. The translation is still in use to this day

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Chatelet's adult life was dominated by her work in physics, philosophy and mathematics, resulting in the publication of many papers and essays on the subjects, including her philosophical magnum opus (considered to be her best work), *Institutions de Physique* (1740) which was republished and translated into several languages. Chatelet understood the nature of discovery and advancement, stating that, "Hypothesis are useful because they help us to discover new truths." Although she took part in mathematics discussions at the Café Gradot in Paris, in order to gain entry, she had to dress as a man. This treatment, however, did little to put her off and, determined to be an active part of the scientific community, she had frequent contact with some of the best known scientists of the day including Leonhard Euler and Johann Bernoulli. She also had had a long affair with the writer Voltaire.

When Chatelet became pregnant again at the age of 42, she knew that there was a chance that she would not survive – women over 40, even aristocratic women, often died during childbirth at this time. And so it was, that on the 10th of September 1749, Emile du Chatelet died, just hours after giving birth to a daughter. Her translation of Newton's Principia Mathematica was published posthumously in 1757.

Jocelyn Bell Burnell was born in Lurgan, Northern Ireland in 1943. Her father, an architect, had helped design the Armagh Planetarium and so, with visits to the planetarium, combined with her father's collection of books on cosmology, Jocelyn's path ahead was clear. Despite this, Jocelyn's school remained very traditional; technology was for boys and not girls. This eventually led to Jocelyn attending school in York where attitudes to girls in science were far better. From there, Jocelyn went onto Glasgow University where she obtained her honours degree in physics in 1965 before, four years later, completing her doctorate degree at Cambridge. It was during her time in Cambridge as a postgraduate research student that Jocelyn made her discovery. It was in November 1967 that Jocelyn noticed something out of the ordinary. In 1967, this meant months of checking previously collected data by hand. Eventually, months of hard work revealed a signal from space which seemed to pulsate at regular intervals. For a short time, it was thought that the signal could be coming from another intelligent species trying to make contact. After several further years of observations, the eventual conclusion reached was that it was a rotating neutron star (small but very dense remnant of a super-massive star after its gravitational collapse, composed mainly of tightly packed neutrons) or pulsar. Jocelyn enjoyed a brief period in the limelight, however, she found many of the questions from reporters condescending, sexist and downright insulting; she was after all a highly accomplished physicist and cosmologist.

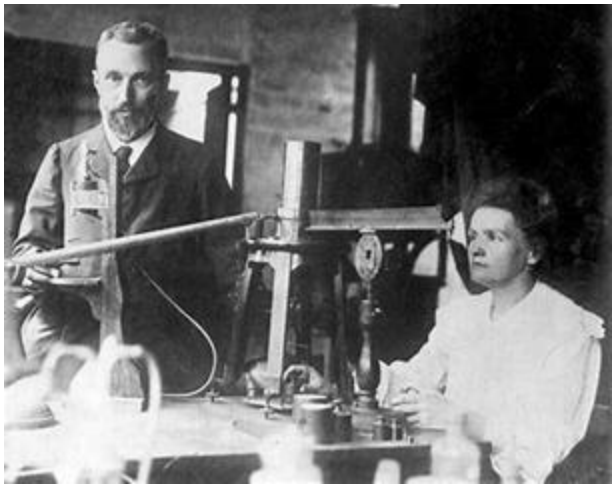
Jocelyn Bell Burnell

It was, however, the next chapter of the story that turned out to be the most controversial. Everyone agreed that it was indeed a great discovery and deserving of the highest recognition and in 1974 the Nobel Prize Committee agreed, awarding the prize for the discovery of pulsars to Anthony Hewish and Martin Ryle. The problem, according to many, and even Jocelyn herself, was that Nobel Prizes had never before been awarded to a student. Instead her supervisor, Hewish, and Ryle, another member of the Cambridge Observatory Team, were given the honour in what many believed was a mixture of sexism and academic snobbery – I agree! Even, the most renowned British astronomer of the day, Sir Fred Hoyle, said her omission from the prize was unfair.

The story of Jocelyn Bell Burnell, did not end there as she went on to have an immensely successful career. President of The Royal Astronomical Society from 2002 to 2004, followed by the presidency of The Institute of Physics from 2008 to 2010 and in 2018 she was awarded the Special Breakthrough Prize in Fundamental Physics, using the £2.3 million prize money to set up The Bell Burnell Graduate Scholarship Fund to support female, refugee and minority groups become physics researchers. And, in recognition of her contribution to science, her picture can now be seen on Ulster Bank £50 notes.

(continued)

The next women is perhaps the best known of all women in science – Marie Curie. Polish born and French educated, Curie was both a brilliant physicist and chemist and it was for her work in radioactivity that she is best known. Marie Sklodowska was born in Warsaw in 1867, then part of The Russian Empire, and gained the first part of her scientific education there, at The Warsaw Flying University. In 1891, she moved to Paris to be with her older sister Bronislawa and it was in Paris where she earned her advanced degrees and would carry out her subsequent work. In 1895 she married French physicist Pierre Curie, sharing with him and Henri Becquerel the 1903 Nobel Prize for Physics for their work on radioactivity - luckily, for Marie, she had only completed her doctorate six months before the Nobel award in December 1903 - and in 1911 Marie won the Nobel Chemistry Prize for her discovery and isolation of the elements (named by her) radium and polonium.



Pierre and Marie Curie, c. 1902

Radium came to be used in many different applications, however, as a result of never registering the name and the techniques used for its isolation she made no financial gains for her (and Pierre's) work. Tragically Pierre died as the result of a road traffic accident in Paris in 1906, falling under the wheels of a horse drawn carriage; killing him instantly. Marie was left alone with their two young daughters and it was only because of the decision by the University of Paris, that decided to offer Marie Pierre's position at the university, that Marie was able to continue her work and provide for her family. Marie had become the university's first women physics professor.

Some believe that Curie did not receive the recognition she deserved in France. This time the reason was not her sex but her religion; Marie Curie was Jewish and much of French society at the time was still divided as a result of the Dreyfuss affair. By 1910, Marie had already started an affair with Paul Langevin. A married man, and himself a renowned physicist, Marie faced angry criticism, and even threats of violence, as she was portrayed as an atheist, foreigner and home-wrecker.

The Great War put a stop to most of Marie's research, however, keen to help her adopted country, and with little thanks for her efforts, she was to play a significant role in using radon for the sterilisation of wounds as well as the use of the recently discovered x-rays for detecting broken bones and internal wounds. The French Government, possibly embarrassed by awards and recognition of her achievements by other countries, most notably America, eventually, in 1921, offered her The Legion of Honour. Marie refused the award but did accept an invitation to become a member of the newly established League of Nations alongside Albert Einstein.

Marie paid a final visit to her native Poland in 1934, dying just a few months later from aplastic anaemia, contracted due to years of exposure to radium. She was buried alongside Pierre in Paris and, sixty-one years later, both were re-interned in the Paris Pantheon; both bodies contained in lead lined coffins due to high levels of radiation.

1927 Solvay Conference – Paul Langevin is seated on the front row, second from the right.

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