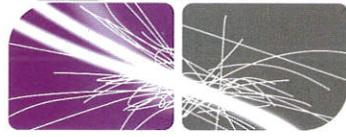


Sci-Circus

Bridging The Boundaries
Between Art And Science



**NOFIT
STATE
CIRCUS**



SCIENCE YEAR
WWW.SCIENCEYEAR.COM

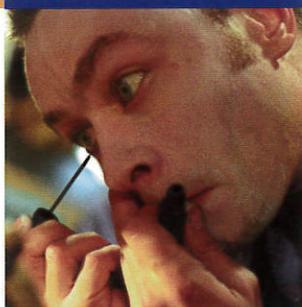
Breaking the barriers between Art and Science

Science is our method of describing the natural phenomena that govern our existence. From our genetic make-up, to the creation of the universe, scientists have developed, tested and theorised explanations. Sci-Circus aims show how much science is involved in the everyday lives of our circus performers and to enthuse you (the audience) to find out what's happening around you. We live in a technological age but how many of us take technology for granted? We will use the excitement of the circus to encourage you to ask how, what and why!

The knowledge that 'seeing is not necessarily believing' is a tool of the circus and other performers. For centuries, magicians and circuses have used illusion and human skill to bewilder, bedazzle and amaze their audiences. We will not be giving an explanation of every trick and illusion we do,

as this is not what we wish to achieve, and it would win us few friends in our world. We believe there should still be room for people to suspend their disbelief and immerse themselves in the fantasy of the show. Life would be less fun if we knew the punch line to every joke. What we wish to achieve is to show that science and its principles can be seen in every walk of life, and that a little understanding can greatly enrich one's appreciation of how things work or happen. We also hope to chip away at the art/science divide, and perhaps show that they are not "exclusive sets, but interacting subsets of creative human endeavour".

**We hope you
enjoy our
performance**



NOFIT STATE CIRCUS

Established in 1985, NoFit State Circus was part of a renaissance of circus that developed into the New Circus movement. They started as street performers, but soon developed into a touring circus theatre company. In 1991 a sponsorship deal with a local steel firm, ASW bought them their first big top, which has toured high quality and innovative shows across the length and breadth of the UK.

Alongside their professional work the company has always been committed to passing their skills onto the community, and this work has developed from running circus workshops to initiating and producing massive community spectacles such as Autogeddon, Prophecy and Now.here. Y2K saw the company buy a stunning and unique big top to further develop its community work across Wales.

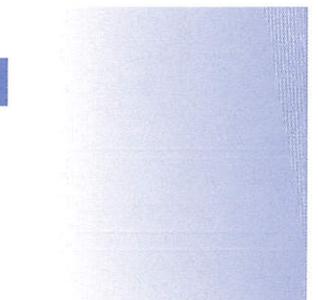
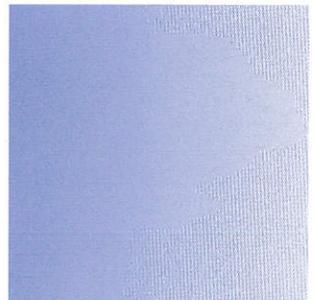
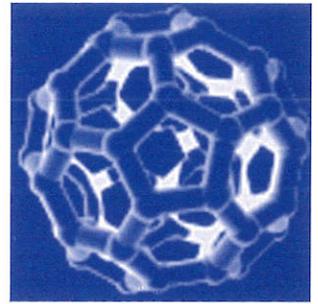
This year the company is proud to be employing one of

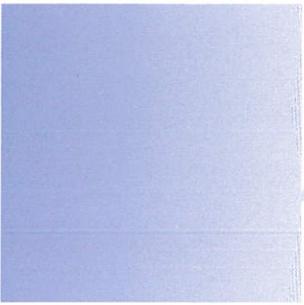
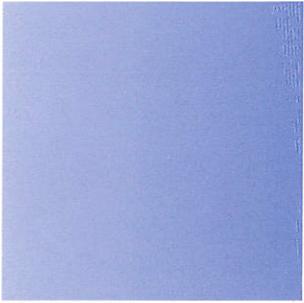
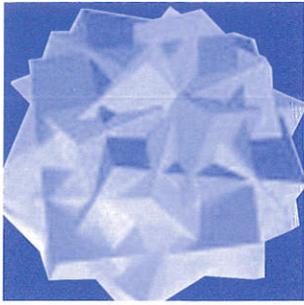
their community participants in his first professional role. Go for it Dan!

NoFit State Circus is once again pioneering a new style of performance. This show is a promenade performance designed to enthuse young people about science. It is a living exhibition animated by our talented group of comic performers. Feel free to investigate and interact with the exhibits and performers and be prepared to move around the space to catch the action. If you find yourself in the frontline please be aware of people behind you and squat down to watch routines.

Inside this booklet you will find explanations to help the science make sense,

**So stand back,
be amazed, and
wonder HOW
and WHY !!!**





Science Year

Fast forward to the future with Science Year, an exciting government initiative crammed with fantastic events for young people. Science Year is particularly delighted to be bringing you the Science Circus. This interactive show brings together a range of engaging experiences, all in the name of science. We hope that you really enjoy it, and that you leave the event inspired and energised.

Science Year aims to improve, forever, the way in which science is viewed, taught and studied so that young people can engage more creatively with a future that is increasingly scientific and technological. We hope young people will view science as highly relevant to the modern world, as diverse and genuinely appealing, and as the basis for a huge range of interesting and rewarding careers. We want to empower them to participate in the wider scientific debate as a key element of a modern, participative democracy.

Science Year is a Government initiative that was launched in September 2001, with the Giant Jump. It is being delivered by NESTA (the National Endowment for Science, Technology and the Arts) on behalf of the Department for Education and Skills and in partnership with the British Association for the Advancement of Science (the BA), the Association of Science Education (the ASE), the Department of Trade and Industry and the Department for Culture, Media and Sport. It operates throughout the UK with parallel operations in Scotland, Wales and Northern Ireland.

You can find out about Science Year through our website – www.scienceyear.com, where you can find games, teachers resources, competitions and event details. It is well worth checking it out.

The Cast

Dan Burston:

The youngest and cutest member of the cast, Dan has been a member of our community circus since he was 15. He has performed in all our community shows and events ever since then. This year he is totally made up to be on his first professional tour equipped with hats, decks and juicy music.

Jonathan Priest:

AKA Ropeman has spent a lifetime trying to keep his feet off the ground, on occasion when he comes down to earth he is a stand up comedian and cabaret artist who has been falling down all over Europe. He can also be seen as the handsome young man on the flying trapeze with long suffering Richard.

Nikki Andrews:

When she's not cracking the whip for a back flip from the rising stars at Circomedia, she's usually found standing precariously (yet hilariously) on her long suffering acrobatic partner. Guess who?

Stumbling from one experience to another has led to performing on stage, screen and street. From Jordan to Japan, Monte Carlo to Milton Keynes, and so to NoFit State...

Richard Durnsford:

Old showman's blood runs through this particular species resulting in a career as a busker and fakir and brief celebrity status as a Japanese game show star. Recent common habitat is under the feet of little suffering acro partner or on top of a Chinese pole. Thing most likely to be said of him: "Oooh, that looks dangerous!"

Peter Reynolds:

Lost in the forests of Sweden he has spent the last few years working with exhibitions, film and research performance. Musically he has continued to develop his style in the field of silent movies. He has again been drawn to circus and this is his 3rd season with NoFit State. A succinct musician and actor favouring the poetic- he looks to the lateral for inspiration, and travels with a large family.

Jenny Sanderson:

has worked with NoFit State on two previous productions "Prophecy and Now.here". We are thrilled to have her back. When she's not in the circus on the swinging trapeze she works as a clown and street performer. She is co founder of Bocadalupa and with this physical theatre company she is also currently touring her solo show "Dodo Diaries".



The Crew

Science Advisor- Gareth (Gaz) Smith: is a lapsed Biochemist who fell in love with hands-on exhibits at first sight of a BernoulliBlower. Since then he has worked for various science exhibitions around the world. He has always had the strong desire to combine science with circus and is now able to fulfil that aspiration being the scientific brains behind the operation. Although aspiring to stand on the shoulders of giants he seems to have got stuck somewhere around the navel.

Technician- Adam Cobley: started working on a few events with NFS last summer. This meant a chance to see more and more circus performance, a nice change from the theatre productions, conferences and parties he would normally rig sound and lights for. It's great for him to be working on a show that is more than just the same old tricks and really demonstrates the physics behind circus skills.

Tour Manager- Tim Adam: first met the circus in 1990, by 1991 he was their tent man and by 1993 their administrator and full time partner. In 1997 he ran away to work for Circus Space to co-ordinate the performers of the Millennium Dome Show. However, not surprisingly, he couldn't stay away. "Touring Britain with this circus is the best" he reckons.

Paddy Watson: says "I can't remember when I first met NoFit State Circus but it seems they've always been around and it was a slow gravitation towards them. Some time after the Cornwall eclipse I climbed out of a muddy archaeologists hole and realised I was in NoFit State from now onFrom free festivals to carnivals they are the only bunch I know who challenge the conformity of the spectacle today (and that's why I don't mind fixing their trucks!)

Michaela Freire-Reynolds: has a job to be commended – She is responsible for the delivery of hot and tasty food to the whole company. When she's not cooking she can be found behind the Café/shop or looking after and schooling the three youngsters of the company Winston, Valentine and Bella.

Cover illustration and poster design:

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Dave 'Grooveslave' Morris

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Spectrum

Behind the Scenes

**Director-
Peta Lily:** directs and devises shows, plays, operas.....And now circus. She performs as an actress in both mainstream and independent theatre. She has created numerous one-woman and two-handed shows and has toured the UK, Europe, Mexico, Hong Kong, Australia and Brazil. She has written two full-length plays, *The Porter's Daughter* and *Blame*. She recently wrote and directed *Random Oracle* for the Unity Theatre, Liverpool. *Blame* recently premiered in Athens. She is currently touring her hilarious and touching show, *Topless*.

**Devising director-
Luci Gorell Barnes:** is a talented director, deviser and performer who has retired from a career in street theatre to work as a visual artist. In the past she has worked on several NoFit State Shows. Fortunately, she misses the smell of sweat and sawdust so much that she was easily persuaded to come back and help us devise this piece.

**Producer-
Ali Williams:** This is the first ever production by NoFit State Circus that Ali hasn't performed in. She has now graciously moved behind a desk to make way for younger talent. Ali had to write a business plan for her arts management course, she consulted with Gaz and between them they came up with the brilliant idea of a Science Circus. A year on, an A++ from college, and with funding from Science Year, she has turned the idea from a thick bundle of paper into the show you see before you.

**Design and environment
co-ordinator-Tom Rack:** co-founder of NoFit State Circus has also left performing behind to nurture his interest in installation art and multi-media technology. Sci-Circus is the perfect show to incorporate Tom's talents and in collaboration with Sean and Gaz he has created the environment around us. Tom's speciality is turning the performers ridiculous requests for strange equipment into working and useable objects.

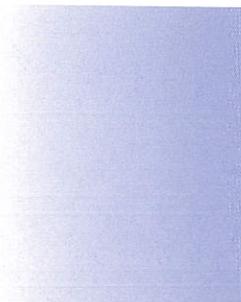
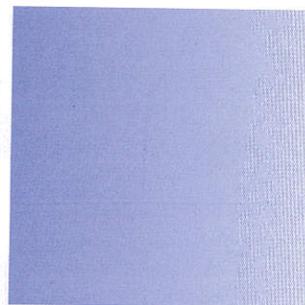
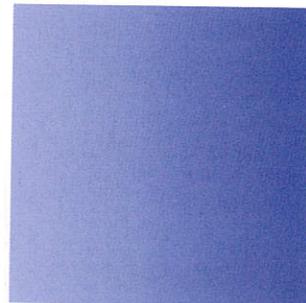
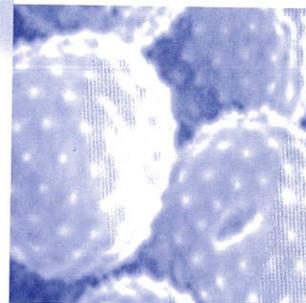
**Designer-
Sean Donohoe:** has been the company's favourite designer since *Treasure Island* in 1997. This year he has traded in the sewing machines for a fancy laptop on which he draws colourful fluffy pictures to be turned into sets.

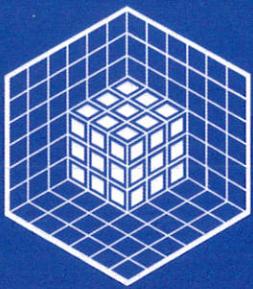
**Electrician-
Denis Power:** courts danger. He has been responsible for the electrical installations for NFS for 4 years and is highly experienced at bringing together the disparate elements of water, mud, electricity and light.

**Production Supervisor-
Adrienne Hill:** NFS has woken up and stirred the spirit of this girl from the sleepy hollows of Mid Wales. Youth and Community theatre based, studying Production Management at the Welsh College of Music and Drama. Now learning a whole new language of the circus. She only came to help put the tent up!

**Stage Manager-
Linsey Hall:** has just finished a drama degree and on route discovered that she prefers to be behind the scenes although after working with this lot she may change her mind again!

**Design Assistant-
Rhi Matthews:** A graduate of Welsh College of Music and Drama, Rhi discovered circus last year, she yearns to be a performer one day and walks on stilts in her spare time. In the mean time she has taken over the paintbrushes and sewing machines from Sean.





Is this a white cube in a corner or is it a blue cube with a corner cut away? This design "flip flops".



These three strange fish share only one head!

8

Introduction

Hello and welcome to Sci-Circus. We are on tour around the country as part of Science Year, and we hope to show you that science is not just about labcoats and test tubes, but also juggling, tightrope walking and lots of other things that go on in a circus. But don't worry - there's no test or exam at the end. We want you to enjoy the show and use this booklet as a way to understand a little bit more about what is going on. From bending a ball like Beckham to balancing it on your finger, explanations of how and why things happen can be both useful and fun.

Gravity and juggling

Gravity is a force that attracts things together. It holds us to the planet, and keeps the moon spinning around. You feel this force as your weight, which is your mass (all the bits of your body) times the pull of gravity. If you jump from a plane, gravity makes you get faster as you fall. But gravity makes all falling things get faster at the same rate, so a falling juggling ball will hit the

ground at the same time as a much bigger basketball. This means that jugglers can juggle with objects of different size and still be able to predict their movement. Also, balls thrown higher will take longer to come back, so you can juggle higher and slower, or lower and faster.

Air resistance can slow the acceleration of a falling object. Things which have a large air resistance compared to their weight, such as parachutes, will fall more slowly. In fact, if there were no air around, a feather would fall at the same rate as a heavy iron!

Try this: Hold two balls of different size and weight (say a football and a tennis ball) at the same height. Drop them at the same time, and see if they both hit the ground at the same time. Now fill a binbag with air and tie a knot in it. Take another binbag and knot it, but with no air inside. Drop both the bags from the same height and see which one lands first. Weigh the binbags to see if there is any difference in weight.

What's happening: The balls will both fall and hit the ground together because gravity makes them accelerate at the same rate even though their weights are different. The binbag with air in it will fall more slowly because of higher air resistance.

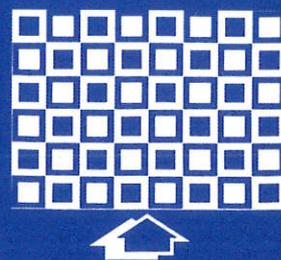
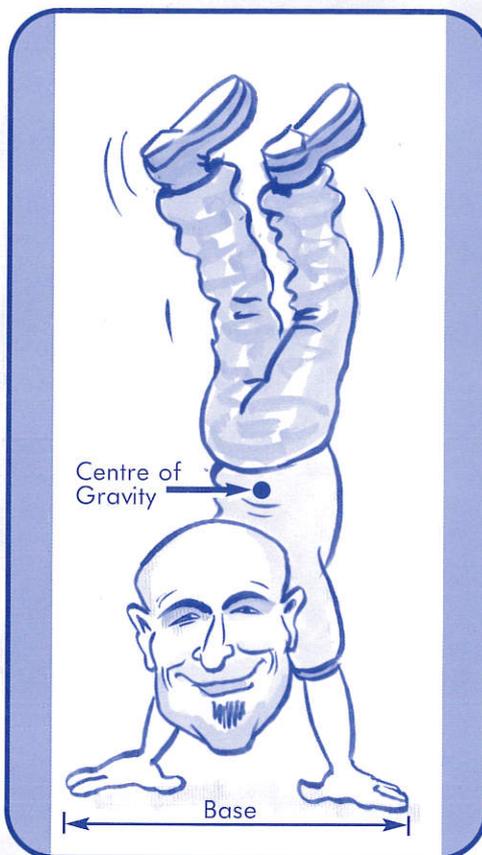
Balance



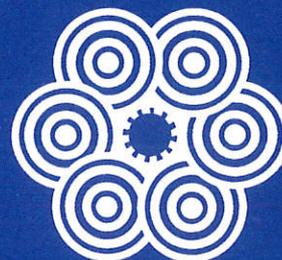
Everything has a point called its 'centre of gravity'. To balance something we must support it under its centre of gravity or the object will fall over. In people the centre of gravity is located in the middle of the body somewhere near the belly button. Usually our support comes from our feet, but circus performers use many more parts of their bodies, such as their hands, during acrobatics and acrobalance. You can increase your stability by making your support, or base, bigger, say by standing with your feet further apart. Another way is to lower your centre of gravity. Many martial arts stances use these methods.

Try this: Stand back to back with a friend and try to touch your toes at the same time. What happens?

What's happening: As you bend over forwards, your weight distribution changes, and your bottom must also push out to stop you falling over. If your bottom can't push out because your friend is in the way then you will topple.



This blue and white design seems 'higgledy piggledy' - but it is a uniform pattern. Hold the page and look in the direction of the arrow and you will see perfectly straight lines of squares.



Rotate this page in a circular motion. Each circle will appear to revolve on its axis. The inner cog wheel will appear to rotate in the opposite direction.

Tightrope unicycle

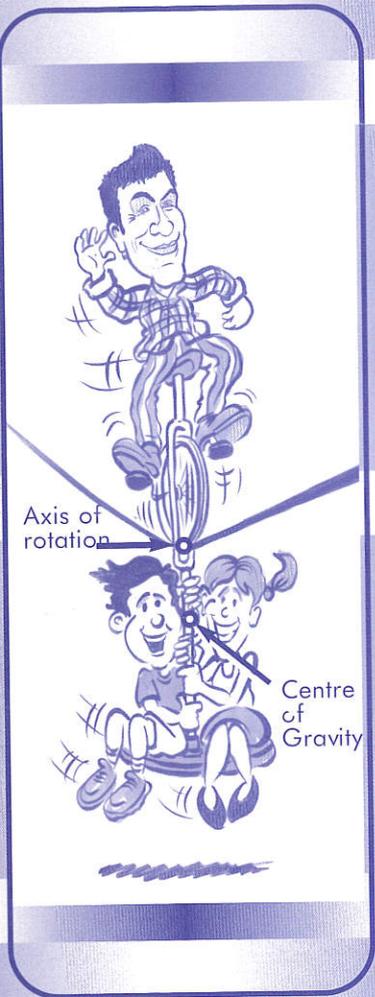
A way of increasing the stability of an object is to lower its centre of gravity. In the show, our tightrope unicycle has been specially made so that there is a lot of weight low down. This makes the centre of gravity act below the tightrope (the axis of rotation), and so makes it very difficult to fall.

Tightrope walkers pole

Tightrope walkers use a pole to help them stay upright. The point where the walker's foot meets the tightrope is called the 'axis of rotation'. All spinning things have an axis of rotation. The pole also has an axis of rotation, and because it is very long, it needs lots of force to start it spinning. This is called 'rotational inertia'. If the tightrope walker starts

to fall, he twists the pole, which pushes back on him and helps him keep his balance.

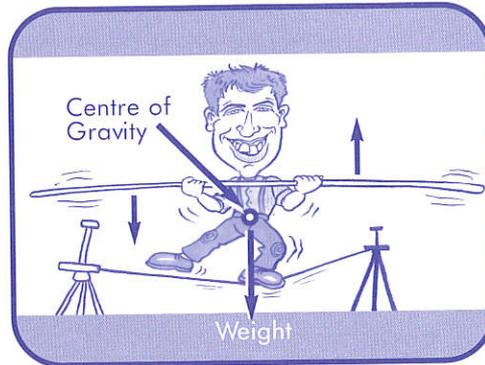
Try this: Take a broom handle, or similar length of wood. Put a ball of plasticine or clay nearer one end. Now try balancing it on the palm of your hand (which will



become the axis of rotation). Which is easier - with the weight closer to your hand, or further away?

What's happening:

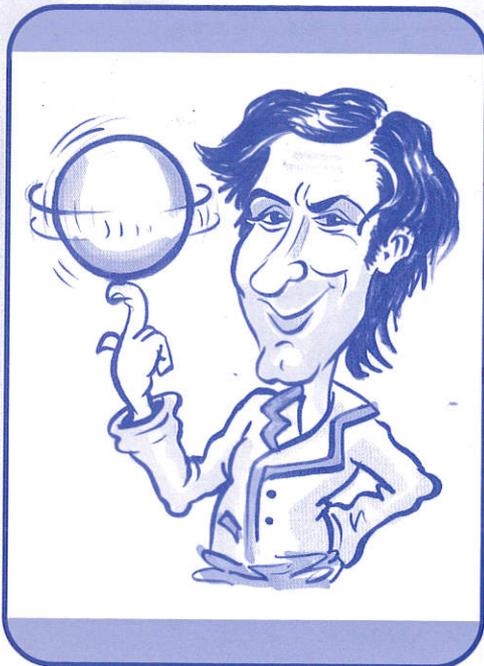
Rotational inertia depends on how far away the object's mass is from its axis of rotation. The further away this is, the slower it will topple. The stick with the weight furthest from your hand will be the easiest to balance because higher rotational inertia gives you more time to move your hand, and so keep the stick upright.



Hat juggling and gyroscopic stability

A hat thrown any old way is unpredictable, and so not much good for juggling. A hat thrown with spin, like a frisbee, has a lot more stability. This is called 'gyroscopic stability' and is the reason why a moving bicycle stays up better than a stationary one, and why a spinning coin on a table top will stay upright until it slows down.

Try this: balance a basketball or football on your finger. Is it easier



with, or without, spin? Throw a frisbee with and without spin. Which works best?

What's happening?: in both these cases spinning the ball or frisbee increases gyroscopic stability.

The Carousel.

The finale of our show has the performers spinning around the tent pole on ropes. To make an object spin around like this requires force, because objects naturally 'want' to move in straight lines. The tension in the ropes pull the performers towards the centre. This is called 'centripetal force' which means 'seeking the centre'. If the rope breaks, the performer would carry on in a straight line. The performer feels an apparent outward force to balance this inward one, and this is known as 'centrifugal force'.

Try this: In a safe place, swing an object tied to a string around. Let go and notice that the object flies off in a straight line. Next, put a small amount of water into a small bucket. Swing the bucket around horizontally and notice what happens to the water. Why doesn't it tip out? When you have had a few attempts try swinging it around vertically, but be careful!



Do you see this as a vase or as two faces looking at each other? This classic illusion is known as 'The Rubin Vase'.



This sketch shows an old lady and a young girl - can you find both of them? Clue: the young girl's chin becomes the nose of the old lady.



Rope and pole routines

Both these routines depend on a force called friction. This force makes it difficult for surfaces to slide over one another. Pushing surfaces together increases friction and makes it more difficult for them to slide. The rope routine performer never actually ties a knot, but cleverly winds the rope in ways that increase the frictional forces and stop the rope slipping and him falling. Do you think that the pole routine would be easier or harder if the pole were more slippery (less friction)?

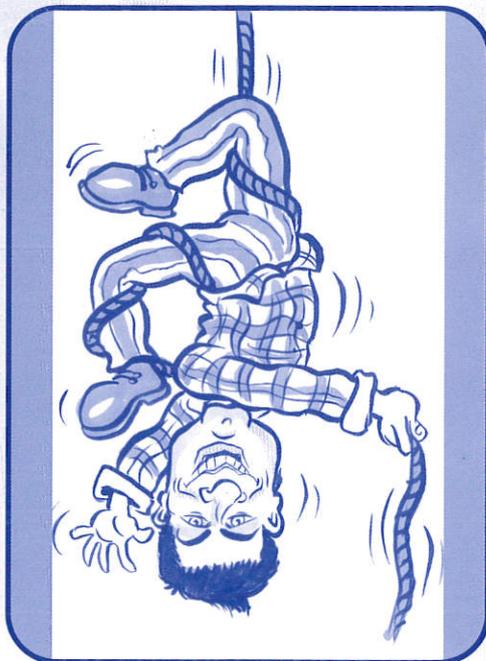
Try this: Rub your hands together briskly. Can you feel them getting warm?

What's happening: Your hands get warm because of the friction between them. This releases energy as heat, and so warms your hands.

A design where the question is...do you see blue lines on white or white lines on blue.

When you carefully read the words in a paragraph, like like this one, it is easy to to make a mistake. In in fact you might be be making one right now now unless you are are reading very, very slowly!

Do you notice anything unusual in the above paragraph?

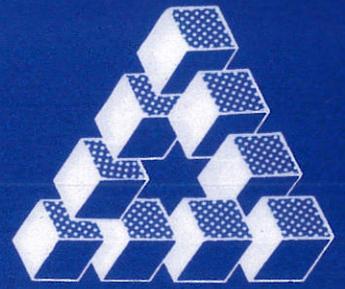


Sound

Sound is made when things vibrate. The faster the vibration the higher the pitch, or note, of the sound. Slow vibrations mean low notes. The vibration passes through the air in a sort of Mexican Wave until it reaches your ear. This causes part of your ear to vibrate and passes messages to your brain, which your brain reads as sounds. To make a loud sound, you need to vibrate more air. This is called amplification. The quiet sound of the music box is made much louder by attaching it to a bucket, or tray, which then vibrates a larger amount of air.

Try this: Put different amounts of water in three identical bottles, and tap them with a spoon. Which one sounds the highest note? Now blow across their tops to produce a note. Does the same one make the highest note?

What's happening: The bottle with least water will make the highest note when hit with the spoon. This is because it has the least amount of stuff to shake about, and so vibrates more quickly. When you blow across the top you are vibrating the air. The bottle with least water allows more air to vibrate, and so it now sounds the lowest.

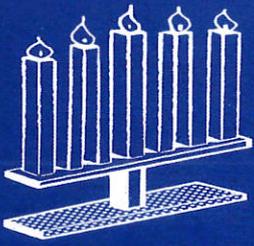


These nine cubes form a curious impossible triangle and can you see the shape formed in the middle.

NOW NO
SWIMS
ON MON



The sentence on the notice is supposed to be the longest one which still reads the same when turned upside down! Try it.



Light

Light travels in straight lines. Shadows are created by putting an object between the light source and the screen. Because light travels in straight lines, the closer the object is to the light source, the larger the shadow. Light also has energy. This energy can be stored by the luminous 'flash paper' in the show, and then let out again. This makes the paper glow. The darker shadowed area is where no light fell.

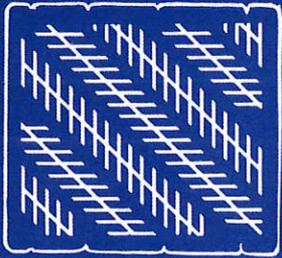
Coloured lights are used in theatre to create mood effects, for example, blue for night time and red for sunsets. Viewing objects in different types of light can affect their apparent colour. Watch our acrobalance routine and see

the way the performers' costumes seem to change colour.

Try this: Look at the colours of cars at night under sodium orange street lights, and again during daylight hours. Do the colours look different?

What's happening: We see colours because of reflected light entering our eyes. Different 'coloured' objects absorb different wavelengths of light, and therefore appear different colours. White light (like the light from the sun) is made up of different colours, or wavelengths. During the day we see lots of different colours, dependant on how this white light is absorbed and reflected. Streetlights only emit one wavelength, or colour of light. This means that objects seen in this light appear to be less colourful.

How many candles are there? First count the flames - 5. Now count the base of each candle and you'll find there are 7!



The long diagonal lines are parallel to each other - but they look crooked because of the short hatched lines.

Arch bridge

The arch bridge works by each piece supporting the neighbouring pieces, and spreading the load evenly to the ground. Arch bridges are one of the oldest types of bridge.



Pulleys

Pulleys are very important to circuses as they can be used to help you lift things, including the tent itself. Although the tent is very heavy, a system of pulleys, called a block and tackle, gives you five times more pulling power. However it also means that you need five times the length of rope.

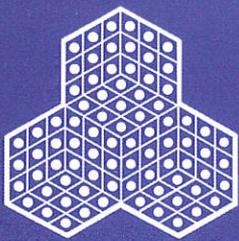
Hall of mirrors

In our hall of mirrors you will see different images of yourself. These images are different because of the different types of mirror used. There are curved in (concave) and curved out mirrors (convex). Convex mirrors always make you appear smaller, but concave mirrors can produce different effects, depending on whether they are horizontally or vertically arranged, and how close you are to the mirror. Combinations of the two are great fun to look at!

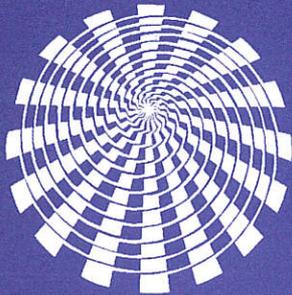


Try this: Move backwards and forwards in front of the mirrors and wave your right hand at yourself. What happens to your image? Can you find a mirror that shows your reflection as other people see you, rather than as a 'normal' reflection, which is reversed left and right.





How many cubes are there here? Can you see the hidden one in the centre of the design



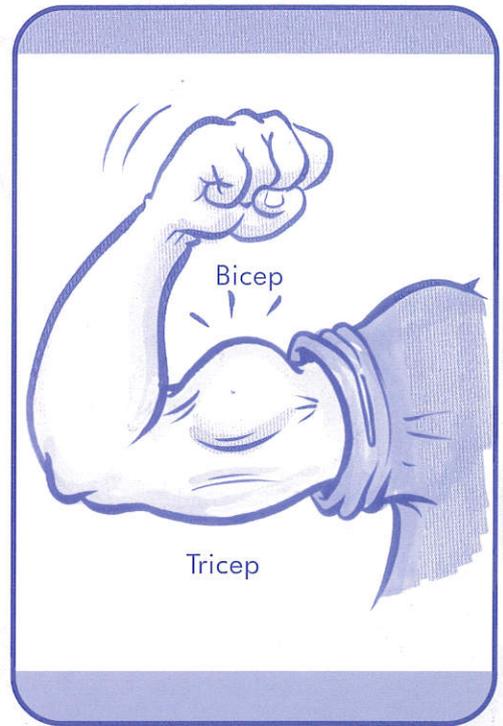
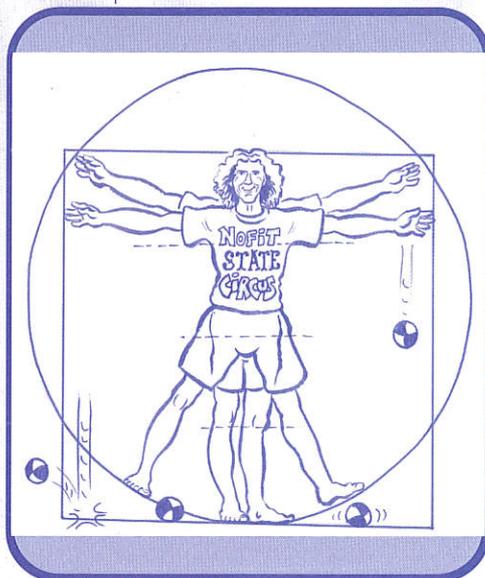
This looks like a spiral - but it is not. It is a series of concentric circles. To prove that they are circles, trace one of them out on a compass.

The human body

Last, but by no means least, the human body is a very important part of circus. Performers train very hard to enable them to achieve their feats and stunts, but their bodies are the same as yours. They use their muscles to haul themselves up and down ropes. Muscles work in pairs. One type of muscle lifts the arm, and one type lowers it.

The juggler's eyes send messages to their brains, which helps them place their hands in the right place to catch a juggling ball. This is called hand to eye coordination.

These are just two examples of how our amazing bodies work. Can



you think of any more things that our bodies can do that are especially useful to circus performers?

Try this: Get a friend to hold your wrist. Try to raise your arm, and notice which muscle flexes, or contracts. Now try to lower your arm. Does the same muscle flex?

What's happening: Your biceps muscle flexes, or contracts, when you raise your arm, and your triceps muscle, which is on the opposite side of your arm, flexes when you try to lower it.

We hope you have enjoyed Sci Circus today. We would really appreciate it if you could spend a couple of minutes telling us what you thought of it.

Please answer for yourself only by placing a tick next to the answer which best applies.

Put your completed questionnaire in the box provided, or hand it to any member of Sci Circus or if you fill this in at home post it to the address on the back of the programme. Thank you!

About Sci Circus

How did you hear about **Sci Circus**?

Did you enjoy **Sci Circus**?

- Yes, a lot
- Yes
- No
- Not at all

What part of **Sci Circus** did you enjoy the most?

What part of **Sci Circus** did you enjoy the least?

What did you think of the information booklet?

- Too easy
- Just right
- Too hard
- I Haven't read it yet

Would you recommend **Sci Circus** to your friends or family?

- Yes
- Maybe
- No

What surprised you about **Sci Circus**?

Please use this space to write down anything else about **Sci Circus** you would like us to know:

P.T.O.

About you

Who are you here with today?
(Please tick as many as are appropriate)

- My parent/guardian
- My grandparent(s)
- My partner/spouse
- My child(ren)
- My grandchild(ren)
- My friend(s)
- Other family
- School

When was the last time you visited an arts event?

- In the last 6 months
- 6 - 12 months ago
- 12+ months ago
- Never

When was the last time you visited a science centre / science museum?

- In the last 6 months
- 6 - 12 months ago
- 12+ months ago
- Never

If you haven't been to a science centre / science museum in the last 12 months would you consider visiting one now that you have seen **Sci Circus**?

- Yes
- No

About Science Year

Did you know that it is currently Science Year?

- Yes
- No

Have you attended any other Science Year events apart from Sci Circus?

- Yes (please specify)

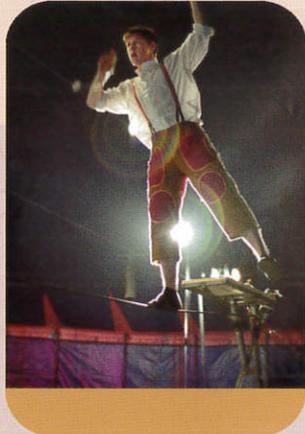
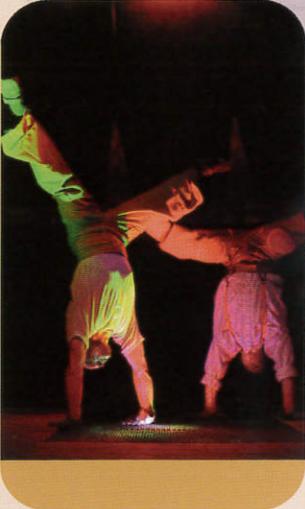
- No
- Don't know

Have you used the Science Year website (www.scienceyear.com)?

- Yes
- No

If you would like to receive the Science Year 'Wired Up' monthly email newsletter, please write your email address here:

Thank you very much for your help.



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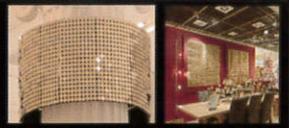
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