Perception Deception Exhibit Support Notes

Visual perception exhibit: Which way do they turn?

When you use this multimedia exhibit…you'll watch dots on a screen, which look like nine hollow, spinning spheres. If you watch the spheres long enough, you can 'will' them to all change direction at the same time, or to spin in opposing directions. The animation of the spinning spheres doesn't actually change, it's purely your perception of how they move and perceptual rivalry in your brain.

This exhibit was based on work by Professor Jack Pettigrew, University of Queensland.
http://www.uq.edu.au/nuq/jack/rivalry.html

Professor Pettigrew is researching whether each hemisphere of your brain may be involved in switching the direction of the spinning spheres during perceptual rivalry.

Do you have an indecisive brain?

As you watch the dotty spheres spinning, you'll see them switch and spin in different directions. When you see something that could be interpreted two different ways, your brain's visual system 'flips' each interpretation back and forth, because it can only handle one interpretation at a time. This is called perceptual rivalry. Perceptual rivalry techniques are sometimes used in art works and illusions like impossible objects (http://en.wikipedia.org/wiki/Impossible_object).

Even artists like Salvador Dali took advantage of our perceptual rivalry. Look at his painting Market with the Disappearing Bust of Voltaire.
(http://en.wikipedia.org/wiki/Slave_Market_with_the_Disappearing_Bust_of_Voltaire) Can you see the bust of Voltaire and the two women at the same time, or does your brain keep jumping between the two interpretations?

Visual perception exhibit: Which row of chess pieces is darker?

When you use this hands-on exhibit…you'll look at a picture of chess pieces which are pictured against black or white 'fog'. The chess pieces appear to be different shades of grey, but when you slide a plain grey panel over the chess pieces, they change shade before your eyes.

This chess piece illusion (originally developed by Professor Bart Anderson) reveals how your brain processes three layers of information when you're trying to work out how light or dark something may be. If your brain didn't compare contrasts and boundaries between objects, you wouldn't be able to read a book in dim light or see things under moonlight.

Shadows look like solid, black shapes, so why don't you trip over them? Your visual system uses a series of filters to know that shadows are just shadows.

Every time you look at an object, your brain assesses the illumination, reflectance and transparency of something to determine how light or dark it is.

The rows of chess pieces in this Perception Deception exhibit are the same, but they're placed against black fog or white fog surroundings.

Because your brain compares the chess pieces to their foggy surroundings, you mistakenly (but understandingly) assume that the rows of chess pieces must be darker or lighter than each other.

The foggy surroundings make the chess pieces appear darker or lighter, because your visual system breaks the pictures down into three layers:

- illumination (how much light hits the surface of the chess pieces),
- reflectance (how much light the surface reflects to your eyes) and
- transparency (anything like a curtain, smoke, shadow or glass that the light needs to pass through).

Somehow, your brain makes allowances for these different contexts and adjusts for the conditions.

Visual perception exhibit: What do you see in the mirror?

When you use this hands-on exhibit…you'll place some puzzle pieces around a column-shaped or cone-shaped mirror. The puzzle pieces seem to look smeared or warped, but when you put the pieces in place and look at the mirror, you'll see something more recognisable.

You've probably noticed stretched or anamorphic images on bike paths or football fields, but did you realise that anamorphic images have been around for several hundred years?

Can you keep a secret using a mirror?

Anamorphic images were first used in artworks several hundred years ago. Then they were adapted to contain political messages and risqué images which could only be viewed if you had the correct mirror. Today, anamorphic advertising on football fields is painted onto the grass, so when it is viewed from the television camera angle, the writing almost appears to stand upright.

Similarly, footpath chalk paintings sometimes use anamorphic techniques to create the illusion of a crevasse or a swimming pool in the middle of a footpath for people who are viewing it from a distance.

Visual perception exhibit: Watch the spinning disc and see things expand!

When you use this hands-on exhibit…you'll stare into a spinning disc, then quickly look at something else and notice a very strange effect.

Just as your eyes adjust from bright light to dim light when you walk into a dark cinema, your visual system also needs to adjust from watching fast motion to something more stationary. If you stare into a large water fall in a garden, then look off to the side, you'll probably notice surrounding bushes or rocks start to 'wobble' and 'boil'. This is due to a motion after effect.

Is your world really in a spin?

A motion after effect makes things appear to 'expand' or twist, even though the things don't actually change size or move. The effect is caused by how cells represent motion in your brain, particularly in your visual cortex.

There is debate over whether the motion-sensitive cells in your brain become fatigued or not, but continuous motion in a certain direction leaves us with a bias in the other direction—an after effect.

Different cells in your visual cortex respond to movement in different directions, but the motion after effect works if you see movement in part of your visual field, rather than your whole visual field. So when you are driving down the highway in your car, you see everything moving and you don't get a motion after effect when the car stops.

When you're riding in a train however, you only notice movement through a smaller window, while the carriage seats and walls seem to be still. When your train stops, the station platform can sometimes appear to move backwards as the motion after effect in your brain continues while your motion cells are resetting.

Visual perception exhibit: Does the grey ring grow darker?

When you use this hands-on exhibit…you'll see a grey ring (called a Koffka ring), printed over two panels. When you slide one panel upwards, the grey ring splits in half and it seems to change shade. The ring's shade doesn't change, only your perception.

Professional photographers take great care in arranging lighting conditions to take into consideration our brain's need for contrast and other lighting effects. If you want to make something look brighter, place it next to something that's dark.

Your brain can't take accurate measurements of light, like an electronic light meter. Instead, your brain judges the 'brightness' of a shape by comparing it against its background or surroundings.

So, something generally looks brighter or lighter if it's next to something dark and vice versa. This effect is called brightness contrast. Your brain also notices borders around objects when it is trying to judge a shade. It can do this because of how cells in your retinas respond to light.

If you are in a darkened room with a tiny pinpoint of light off to your left, only certain cells or cones in your left eye's retina are stimulated. When a stimulated cone cell fires away, neighbouring cone cells are inhibited, so they don't fire at the same time as the first cone cell. This is called lateral inhibition.

When neighbouring cones cells are inhibited, it contributes towards brightness contrast, because the apparent brightness of an object becomes more defined against its surroundings, making it appear brighter.

Visual perception exhibit: Do you see the same yellow?

When you use this hands-on exhibit…you'll see a circle of ping pong balls illuminated by LEDs (light emitting diodes) so they look 'yellowish'. The middle ping pong ball contains pure yellow LEDs, while ping pong balls in the surrounding circle have different proportions of red and green LEDs to give yellowish coloured light.

You need to choose the ping pong ball in the circle that most closely matches the yellow ball in the centre. However, you may find that your friends or family do not agree on which pair matches best!

If you're arguing about a paint colour, don't blame the paint company! Blame genetics and perception. We all differ in our colour perception, thanks to differences in our genes and trichromacy, which is the technique humans use to perceive millions of colours.

Light receptors (or cones) in your eyes detect certain wavelengths of light and generate colour responses in your brain. So your brain 'sees' or perceives colour rather than your eyes.

Now you may assume that you've got a huge range of cones for all the colours in the world, but your eyes can only actually detect three wavelengths of light:

- Light at around 480 nanometres is seen as 'violet' by your brain (detected by short or S-cones in your eyes).
- Light at around 530 nanometres is seen as 'green' by your brain (detected by medium or M-cones).
- Light at around 650 nanometres is seen as 'red' by your brain (detected by long or L-cones).

Hang on! You can see so many more colours than just red, green and violet. And there are no 'yellow' cones, so what happens when you see yellow?

Light at 570 nm is interpreted by your brain as 'yellow' and mixing red and green spotlights creates light which your brain also interprets as yellow.

Your cones which respond to 530nm ('green') and 650 nm ('red') wavelengths of light are both being stimulated when you see 570 nm light.

Your brain combines the nerve signals from these two sets of cones and you perceive yellow.

The light itself doesn't change, but your brain processes the information differently so you perceive colour.

But our genes play a role in how we see colour too. Because we all have slightly different genes, we also have slightly different amino acids called photo pigments in our cones. This tiny molecular difference produces difference in colour perception between people.

Some people are more sensitive to 650 nm ('red') light, while others are more sensitive to 530 nm ('green') light. This affects how they perceive yellow coloured lights that are created with a mixture of red and green light.

Visual perception exhibit: Do you see 3D?

When you use this hands-on exhibit…you'll look at special two dimensional (2D) photos through coloured filters, so they look like they're three dimensional (3D). This technique is commonly used for 3D effects in movies and recent video games, but how does it work?

Don't view the world through rose-tinted glasses, try anaglyph glasses! The pictures in this exhibit may look as though they have been misprinted, but they are really anaglyphs.

Anaglyphs have two 'snapshots' of the same picture from slightly different angles and in different colours. Printing the pictures so they overlap mimics the view you have from your left and right eyes in your skull.

You can check how different each eye's view is normally by looking at something in front of you and opening and closing each eye. You'll probably notice that things seem to 'shift' in position. This small difference between each eye's view is called disparity.

Each anaglyph picture is printed in different colours (such as one red and one cyan/blue), so when you view an anaglyph through coloured glasses, each eye sees a slightly different picture. When you look at these 2-D anaglyphs through the red filter, the red parts look white, and the green parts appear black.

Through the green filter, the green parts appear white and the red parts look black. Your brain blends together the image it receives from each eye, and interprets the differences as being the result of stereovision.

Multisensory perception exhibit: Can you wipe away a friend's face?

When you and a friend use this hands-on exhibit…you'll find it very challenging and you may even find that it doesn't work.

Together with the help of a friend, you'll use a blank wall and a mirror to create the illusion that you are slowly erasing parts of your friend's face, leaving only their eyes or smiling mouth floating in mid-air. This is based on The Cheshire Cat exhibit by The Exploratorium in San Francisco, USA. This effect is sometimes called The Cheshire Cat illusion, because some people can only see their friend's smiling mouth hanging in mid-air, similar to the Cheshire Car in Alice in Wonderland. Other people get the impression of their friend's mouth disappearing.

Need a harmless way to wipe the smile off someone's face? This exhibit demonstrates how your brain 'fills in' blind spots from your eyes, your preference to pay attention to movement rather than faces and your brain's ability to combine two very different views from each eye.

The back of your eyeballs (retinas) have millions of light receptors, except in one spot where your optic nerve and attaches to your eye ball.

This spot—known as your blind spot—cannot detect any light, but you don't notice this gap in your vision, because your brain 'patches over' the gap by duplicating the colours and patterns being detected by receptors around the blind spot. So when you use the exhibit, your right eye sees the white wall in the mirror and your brain 'fills in' your right eye's blind spot with white.

Also, movement attracts your brain's attention. When you sweep your hand across the white wall, your brain pays more attention to your moving hand in the mirror than it does to your friend's stationary face—and your brain erases parts of their face by your moving hand.

Your left eye sees your friend's face, while your right eye sees the white wall and your hand in the mirror, so each eye feeds your brain with two very different views.

Your brain tries to put these two views together in a way that makes sense, choosing part or all of the view from one eye or the other.

When your brain combines and waivers between these views of your friend's face, it's called perceptual or binocular rivalry.

Visual perception exhibit: Can you see to infinity?

When you use this hands-on exhibit…you'll look into a round hole and see a 'tunnel' burrowing deep into the ground, even though the hole is about as deep as a frypan. This exhibit is similar to a House of Mirrors http://en.wikipedia.org/wiki/House_of_mirrors at a sideshow hall, or even a public restroom which has mirrors mounted above opposite rows of sinks. The reflection between the mirrors creates an image which looks like long hallways that stretch on, and on…and on.

Build a tunnel without lifting a shovel.

This exhibit is made from two mirrors and a row of LEDs sandwiched between the two mirrors.

The bottom mirror is a normal mirror, while the mirror at the top is a 'one-way' mirror, so you can see through the mirror from your side, but the other side is reflective like a normal mirror. Light from the LEDs is reflected back and forth between the mirrors, so they create the impression that you're looking into a tunnel which grows narrower as it grows 'deeper'.

An area in your brain's visual cortex responds to the perceived depth, based on the way the lights reflect back and forth between the mirrors. In a similar way, if you've ever walked into a room which had a wall to ceiling mirror, you probably assumed it was an extension into a longer room before you realised it was simply a large mirror.

Visual perception exhibit: Can you pick up the robot?

When you use this hands-on exhibit…you'll see a toy robot which seems to float in mid-air. If you try to pick up the robot with your fingers, you'll realise that you're grasping at air, because the robot is just a reflective or mirage hologram.

Despite knowing it's a mirage, your brain keeps seeing the robot and you'll try to pick up the robot again, and again, and again…

Magicians and special effect artists often take advantage of the way mirrors or sheets of clear glass reflect light, to give the illusion of something floating in mid-air. This exhibit is not 'smoke and mirrors'. Well…maybe just mirrors...

This exhibit uses two curved mirror surfaces or Mirage® technology to create a three-dimensional hologram of the toy robot, floating in mid-air. The robot hologram is a real image or reflective hologram, rather than a laser hologram. Light hits the robot and reflects back and forth between the curved mirrors, so the light is directed at a focal point above an opening where it creates the illusion of a solid robot.

Your eye-brain visual system cannot tell the difference between a solid object and its reflected image, so it looks solid, even when you logically understand it is not solid at all.

A real image like the robot hologram looks three dimensional and is reversed so it faces back-to-front, unlike a reflection (or virtual image) you see in a flat mirror.

Social perception exhibit: Are you observant?

When you watch this multimedia exhibit video in the exhibition…you'll see Professor Richard Wiseman performing a card trick, where the colour of the cards change.

At the end of the video, Professor Wiseman explains what you probably missed seeing. Every day, we miss big changes in our environment, because our brains can only take in and process a certain amount of information.

Simple games like 'spot the difference' and magic tricks take advantage of our change blindness. In more serious ways, change blindness can influence witness statements about a crime.

Do you see all and think that nothing can get past you?

Richard Wiseman's video shows how your eyes and brain don't (and can't) see or analyse the world in perfect detail. Viewers can be so absorbed in trying to detect when the cards change colour that they usually don't notice the set work or presenters' clothing changing colour.

Researchers have also tracked viewers' eyes (http://www.quirkology.com/USA/Video_ColourChangingTrick.shtml) while they watched the video, to show how people (mostly) miss the real changes that were occurring before their eyes.

Our eyes and our brains can only handle so much information. They need to be selective about what we pay attention to and we compensate for any information gaps by 'editing' together our impressions, rather than taking an exact 'recording'.

Magicians use 'covert misdirection' like change blindness to draw suspicion away from what they're doing and what's changing. The change may be expected or unexpected, but if your view of the scene is interrupted (by a fleeting blink or saccade of your eyes, screen flicker or the camera changing its angle, you are less able to compare the post-change state with the pre-change state and notice any differences.

Multisensory perception exhibit: Is there a delay in what you say?

When you use this multimedia exhibit…you'll talk into a microphone while wearing a pair of headphones so you can hear your own voice being played back just after you speak.

You can choose to delay the feedback of hearing your own voice by a certain number of seconds, (or hear feedback of plain noise). It becomes harder to keep talking as the sound of your voice becomes more and more delayed.

Have you ever used a faulty phone line and heard your own voice echo back through the line? Or maybe you've phoned a local radio station competition and kept your radio playing in the background? In both cases, you probably found it difficult to keep talking, or you kept stumbling over your words, right?!

This exhibit is a fun way to explore how your brain handles the sound of your own voice differently to everyday sounds. You may never tire of hearing your own voice, but you can certainly get confused.

Normally when you're talking, you instantaneously hear your own voice. This allows you to monitor the pitch and volume of your voice, as well as choose and articulate upcoming words.

When you hear your own voice being delayed, it slows down this mouth-to-ear feedback and confuses the language centres of your brain. You stumble over words or have to stop talking.

If you listen to the plain noise in this exhibit (similar to white noise), it's much easier to continue talking. This is because plain noise doesn't interfere with your mouth-to-ear language feedback loop.

Audio0language perception exhibit: Can you fill in the speech gaps?

When you use this multimedia exhibit…you'll hear an audio file of people talking, edited with interruptions of silence, soft noise or loud noise. You need to work out which sentence is easiest to understand: the sentence with silent gaps, soft gaps or loud gaps.

If you're watching a play and someone coughs during a crucial moment, it's annoying, but your brain usually edits pieces together, so you perceive hearing the word that was masked by the noise. Your brain seems to 'fill' in the gaps as though nothing happened. When your brain compensates for bad quality audio information like this, it is called auditory induction, or in the case of human speech, phonemic restoration.

Selective hearing may work when you're trying to ignore someone, but your brain is quite skilled at making sense of bad quality speech. Surprisingly, most people find speech that's interrupted by loud noise easier to understand than speech that's interrupted by soft noise or silence.

In this exhibit, the audio file says:

- "Did you get tickets for the football this Friday?" (Person 1)
- "No, I think I'll go to the movies with my sister, instead." (Person 2)

We edited the audio files with interruptions of loud noise, soft noise and silence, each lasting 100 milliseconds, (similar to work by Dr Makio Kashino)

When your brain anticipates it's about to hear and process language, it will make assumptions about the patterns of sounds and words being spoken, such as phonemes and morphemes and how the words are arranged together (grammatical rules). Morphemes are the smallest possible words or prefixes that carry meaning and they can also be broken down into phonemes.

'Dress' is a morpheme word, while 'un-' is a morpheme prefix. 'Dress' can mean 'put on clothing', but if you add the prefix 'un-', it becomes 'undress' which changes the meaning to 'take off clothing'.

Phonemes are the smallest significant sound units in language, but they're not necessarily syllables. The English language has about 40 phonemes, and they allow you to distinguish between words, such as the difference between 'lap' and 'rap'.

Social perception exhibit: Do people pay attention?

When you watch this multimedia exhibit video… you'll see how a man doesn't realise that he's talking to two different people who had swapped places. It's commonly known as change blindness.

Would you notice whether the person you were talking to had been swapped for a new person?

Illusionists and magicians sometimes rely on covert misdirection which is a form of change blindness to perform their tricks. Spectators can be staring directly at what the magician is doing, but a subtle dimming of lights or falling covers can create enough disruption so people fail to notice any changes between the before and after scene.

This exhibit's video was filmed and donated by Professor Daniel Simons and Daniel Levin (1998) as part of a scientific experiment about 'change blindness' in social situations (http://viscog.beckman.illinois.edu/flashmovie/12.php)

If you want someone to not notice a change, distract them!

In this video, an experimenter stops a 'Passer-by' to ask for directions. Suddenly, two other men barge through, carrying a door (the door interruption). The Experimenter swaps places with a second Experimenter behind the door and resumes the conversation with the Passer-by when the door is gone. But the Passer-by doesn't realise that he is now talking to a different man!

People who watch the video tend to be amazed that the Passer-by doesn't notice that he's talking to a different man.

In the scientific study, about 50% of the Passers-by had no idea that they were talking to a different person after the door interruption, even though the two Experimenters who swapped places behind the door were different height, had distinct voices, and wore different clothing. Passers-by who did notice the swap tended to be students and were from the same social 'in-group' as the Experimenters.

When you look at a scene, you can't possibly memorise or store every detail of what's there. So, you can't compare what you're seeing now with what you saw before.

So, when you're distracted or interrupted by something (like a flickering screen or a door!), you're forced to compare two scenes from memory (even it was just half a second ago), rather than noticing a change as it happens.

Social perception exhibit: Can you pick the gender?

When you use this multimedia exhibit…you'll see two photos which appear to be the same person. You need to judge which face looks more 'feminine' and which face looks more 'masculine'.

Although you may not be aware of it, your brain analyses other people's faces every day for age, gender, ethnicity and facial expression (which indicates mood or receptiveness). This exhibit was based on research by D.M Burt and D.I. Perrett, University of St Andrews, Scotland

The right hemisphere of our brain seems to judge the gender of another person. It also processes information from your left eye. Eye-movements and brain activity has been measured when people look at chimeric (half female, half male) face photos and normal face photos.

The eye-tracking studies showed that viewers tend to fixate towards their left hand side, regardless of whether the viewer judged the photo to be 'masculine' or 'feminine'. In the Perception Deception exhibit, we 'feminised' one half of a face and made the other half more 'masculine', (also known as a chimeric face), then made a mirror image copy. So the faces are equally masculine and feminine, people just perceived them differently.

Social perception exhibit: Can you help me?

When you use this multimedia exhibit…you'll be asked whether you'd be prepared to post on a job application with an attached photo that you found dropped in the street.

Adults who have slightly larger than usual eyes and mouths tend to look more child-like (or neotenous). Because some people look more child-like, you may feel a stronger urge (at face value) to help them.

Do you 'judge a book by its cover'? You might be surprised.

Experiments were conducted in Kenya and the United States of America, where written job applications were dropped in the street.

The applications had photographs attached of a fictional job applicant and a stamped, addressed envelope. Some photographs were digitally altered so the person's eyes and mouth were made smaller, larger, or kept normal-size.

Surprisingly, the applications with 'baby faced' photos (with larger eyes and mouth) had a higher rate of return than the other job applications, meaning that people were more likely to post the found job applications when the attached photos were more 'baby faced'.

It showed that even when allowing for gender and ethnicity, the 'immaturity' of the applicant's face influenced whether people felt a stronger urge to help and post the found job application (or not).

Current research is also indicating that the 'baby faced' qualities of defendants in criminal court cases can influence the jury's decision, or the severity of sentences given by judges.

Social perception exhibit: Can you be fooled?

When you watch this multimedia exhibit video…you'll see Dr Gustav Kuhn performing a vanishing ball trick. Can you work out where the ball went? This exhibit's video was donated by Dr Gustav Kuhn (http://www.scienceofmagic.org/) and Dr Michael F. Land.

We often tend to look where another person is looking and magicians take advantage of this by turning their head or focussing their eyes away from where they're performing a sleight of hand.

When you're next talking to someone and you see them look over your shoulder, see if you can resist the urge to turn around to look where they're looking!

How can you see something that never actually happened?

This exhibit shows how magicians sometimes manipulate our social habits and expectations when they perform 'magic' tricks to fool an audience. When you watch this video, you'll see Gustav throwing a ball into the air and catching it. Then suddenly on the third throw, the ball seems to disappear in mid-air…the vanishing ball illusion!

On the third (dummy) throw, Gustav pretended to throw the ball, by motioning his hand upwards, while moving his eyes and head as though he was watching the ball fly up into the air. In reality, he kept hold of the ball in his hand.

In an experiment, about 68% of people perceived that the ball left Gustav's hand during the 'dummy' throw and that the ball disappeared off screen at the top—even though the ball stayed in his hand. These people had their eyes tracked while watching the video, and it revealed that they looked at Gustav's social cues (head and eye movements) before they looked at where the ball was meant to be at the top of the screen.

This suggests that people's oculomotor control system (i.e. eye movements and bottom up visual processing) was not fooled by the illusion, but their perception was fooled into thinking that the ball had been thrown up into the air.

Audio-language exhibit: Are you speedy or slow?

When you use this multimedia exhibit…you'll try two different 'find-a-word' puzzles.

This is a fun way to show how performance can be affected by words and images. It broadly shows how reaction times can be affected by priming techniques (using words and images).

Sports coaches, motivational speakers and even magicians and illusionists use priming words and pictures to steer people into thinking a certain way.

The next time you're in a supermarket, think about how the images and words are trying to influence your shopping habits.

Are you primed for action?

In a New York university study, subjects were asked to complete word puzzles where they had to form words using a selection of letters. One group were given letters that created words like 'bingo', 'grey' and 'retired', while the other group were given letters that created more neutral words. The subjects were not aware of the purpose of the test and after they performed their 'create-a-word' test, they were allowed to leave the building.

However, the research scientists secretly measured how long it took each subject to walk out of the building. They found that the group exposed to the 'slower' and 'older' words took longer to leave the building than those exposed to the 'neutral' words.

Multisensory perception exhibit: Does swapping stereo fool your eyes?

When you use this hands-on exhibit…you'll wear a pair of headphones while you watch and listen to ringing bells. The headphones let you listen to the ringing bells from the perspective of a model head. When you swap the audio over between your ears, work out which bell is ringing while your eyes are open and closed.

Do you notice how your vision influences where you think the sound is originating?

The next time you're watching television, think about whether the soundtrack seems to be coming from the actors on the screen, or from the speakers mounted near the television, then close your eyes. Can you only believe only what you hear or what you see? It depends!

Your vision works out where things are (the location of something), while your hearing works out when things happen (the timing of something).

When you swap the audio in this exhibit, the audio and visual signals about which bell is ringing no longer match, but your vision dominates to work out the location of the ringing bell.

While vision and hearing tend to wrestle for prime position, a new hypothesis about ventriloquism reveals a more co-operative process for combining your vision and hearing. A tiny round structure in your brain (inferior colliculus) may process both audio and visual signals pre-consciously before they reach your cortex. This means that visual and auditory information may get combined before the 'thinking part' of your brain can make sense of it. As a result, your brain seems to associate the ventriloquist's voice with the dummy's moving mouth before you have a chance to consciously think about it.

Multisensory perception exhibit: Do your eyes make your body sway?

When you use this hands-on exhibit…you'll stand up close to a swaying, black and white striped board. Can you keep your balance?

If you're standing on a footpath watching passing traffic (particularly large buses), you may start to feel a little unbalanced. Or when you play a computer game, or watch a movie, you may get a strong sense of movement, even though you're sitting still.

Your sense of balance is strongly influenced by what you see. When you see that your world is swaying and shaking, your reference point becomes difficult to rely upon and your body may adjust itself in response, even though the ground is completely still beneath your feet.

Did the Earth just move, or did your balance betray you?

When you see your surroundings move, your environment is likely to be moving too (just like when you're riding on an escalator). At other times, if you see your surroundings move, it means that you're falling over. To prevent yourself from toppling over, your body often adjusts how you're standing.

To stay upright, your brain combines signals from—most importantly—your vision, as well as your vestibular system (inner ear fluid canals), and stretch receptors in your joints and muscles (proprioceptors). If you stand still with your eyes closed, you sway 20-70% more than usual, because you are missing vital visual information about how your body is positioned in space.

As we grow older, our vision deteriorates. We often think that this only means it becomes difficult to read or watch television, but it also leads to an increase in falls.

Multisensory perception exhibit: Can you toe the line?

When you use this hands-on exhibit…you'll hold a special pair of prism glasses up to your eyes and try to walk around looping patterns on the ground.

When you look through the prism glasses, your view of the world becomes skewed, as does your sense of balance. Standing and walking is a complex business, so adding these prism glasses to the equation may seem a bit unfair (but it's fun)! Some people feel disoriented, while others don't feel any effect at all when they walk along while using these prism glasses.

Watch where you're walking!

Usually, your brain relies heavily on visual signals to know how your body is positioned in space. The prism glasses force you to only see your feet and the floor. In other words, they remove visual cues about your vertical world.

Because your vision is compromised (compared to what you're used to seeing), your brain defers to your inner ear's vestibular system. Vestibular fluid inside your ears (which helps you stay balanced) signals to your brain that your head is upright. However, your brain is getting visual input about the floor below you instead of what's ahead or in front of you. The vestibular cues conflict with the visual cues of your feet and the floor, so some people become disoriented.

Multisensory perception exhibit: Which shapes feel heavier?

When you use this hands-on exhibit…you'll explore two different weight illusions by lifting and comparing the weight of different shapes. One pair of shapes shows the texture-weight illusion, while the other pair of shapes shows the size-weight illusion.

Have you ever picked up a large box, without realising that it was empty, and almost flung the box into the air? If you did, your brain probably assumed the box would be heavy, so you primed your muscles to use more force than you actually needed.

Bigger isn't always better, or heavier.

Size-weight illusion

The size-weight illusion gives you the impression that a smaller shape (or object) feels heavier than a larger shape, even though the shapes are the same mass.

When two objects are the same mass, but one is larger than the other, your vision unconsciously primes your muscles to lift the larger object with more force or tension compared to the smaller object. Because the large object needs less muscle tension than you unconsciously expected, the larger object feels unexpectedly light. Even though you're getting 'bottom up' signals from your muscles that the shapes weigh the same, you still experience the illusion that the smaller shape is heavier. This size-weight illusion is also known as the Charpentier-Koseleff illusion. If you close your eyes and lift the small and large objects at the same time, the illusion of the smaller object feeling heavier seems to disappear.

Texture-weight illusion

Some people find the smooth shape feels a little heavier than the textured shape, because they need to use a stronger grip to lift the smooth shape, which gives the illusion that it feels heavier.

Multisensory perception exhibit: What do floaty arms feel like?

When you use this hands-on exhibit…you'll push the back of your hands against two poles and walk out from between the poles. Many people feel as though their arms float upwards, as though they're levitating.

Sometimes when you've been carrying a heavy parcel for a long period of time and you put it down, your arms feel strangely lightweight. This is partly because your brain has adjusted your muscles to the stimulus (heavy parcel) and when the stimulus is suddenly removed, your brain needs to readjust your muscles.

You may not be an air-head, but can your arms feel as though they're floating on air?

This old trick (discovered in 1915) shows how your brain and muscles constantly respond and adjust to incoming information from your surroundings. When you push against the poles, your brain sends nerve signals to release calcium ions into your arm muscle fibres. One set of muscles contract so your arms can push against the poles. The resistance of the poles becomes a constant stimulus, and your brain and muscle fibres adapt to the resistance. When you step away from the poles, the constant stimulus is removed. Calcium ions left over in your muscles keep causing your muscles to contract, so your arms rise involuntarily. This muscular after effect (called the Kohnstamm effect) may also be caused by different areas of your brain—particularly your cerebellum—becoming active as the signals from your limbs change or stabilise.

Multisensory perception exhibit: Do you feel a phantom hand?

When you and a friend use this hands-on exhibit…one person will place their hands on either side of a mirror and keep watching the reflection of their hand in the mirror.

The second person will brush or stroke the other person's palms in a particular pattern, so the other person feels their hand being touched, but not see anything touch their hand!

When our brain gets mismatching visual and touch signals, it can feel confusing, even freaky!

Your brain can adapt and remap what it accepts as belonging to your body, what is alien and how your body is positioned in space. This is known as body schema. Some sportspeople start to perceive their sporting equipment (such as a tennis racquet) as being an extension of their own body.

People who feel pain where their amputated limb was once positioned are said to suffer from phantom limb syndrome (http://en.wikipedia.org/wiki/Phantom_limb). Similarly, some people who have intact arms or legs feel such a strong rejection of a limb that they need to have it surgically removed.

Does your body really belong to you? Are you sure?

When using this exhibit, some people start to assume that their and's reflection in the mirror is actually their left hand and not simply a reflection of their right hand. So, when they can see that nothing is touching their 'left' hand, but they feel something touching their 'left' hand, it can feel unsettling.

It may also generate the sensation of a phantom limb (http://en.wikipedia.org/wiki/Phantom_limb) in people who have two complete arms and hands. Phantom limb sufferers feel that they can move their 'phantom' but the phantom limb feels 'paralysed' in a cramped and painful position (even when the sufferer can see the limb's not there).

Our brains process matching sensory signals every day, such as simultaneously seeing and feeling something touch our hand. This exhibit (and a therapeutic mirror box) provides your brain with conflicting feedback from touch and visual channels. Your body schema gets confused and your brain finds it difficult to calculate where your (hidden) arm is located.

An area of your brain called the somatosensory cortex is like a strip that runs over the top of your head a bit like a head band. This area handles tactile sensations from your arms and legs as well as your face.

Body schema maps of your limbs are malleable and changeable (neural plasticity). Research is still being done on why this feeling or paralysis occurs. Phantom limb paralysis develops because every time the patient attempts to move the 'paralysed limb', the patient receives sensory feedback (through vision and proprioception) that the limb did not move, which is translated and reinforced as 'paralysis'.

Multisensory perception exhibit: Do any lines feel longer or shorter?

When you use this hands-on exhibit…you'll close your eyes and feel six different lines. Even though all of the lines are the same length, some will feel longer or shorter than others (similar to when you simply look at the lines).

Humans are very dependent on vision, but we can also rely on our sense of touch when we are trying to work out the size and shape of things. Vision impaired people, including people who have been blind since birth, have also experienced the Müller-Lyer line illusion when they feel the lines. Scientists aren't sure why this is the case, but they continue to research the visual and tactile version of the illusion.

Do you 'see' with your fingers as well as you can see with your eyes?

Maybe when you feel the Müller-Lyer lines with your eyes closed, your brain is interpreting the straight edges like the corners of a box? These well-known visual illusion lines are all the same length. The arrowheads make the lines appear longer or shorter, possibly due to how your brain processes size constancy and is used to the straight parallel lines of urban roads and buildings.

For example, the interior corner of room is similar to the lines where the arrowhead fins point outwards. The exterior corner of a building is similar to the lines with arrowhead fins pointing inwards.

Size-constancy is how your brain calculates the size of a shape, based on the size of the image it projects onto your retina, as well as how far away (or nearby) your brain believes the object to be.

Multisensory perception exhibit: Can wire feel like velvet?

When you use this hands-on exhibit…you'll run your hands over hard wire to see if you can feel the Velvet Hand Illusion (VHI)

Research on the Velvet Hand Illusion is being used by Japanese scientists to develop virtual reality experiences and other touch technology, such as tactile sensors and displays. Virtual reality games use sights and sounds to create virtual worlds, but other developers are researching taste, smell and touch to make games more vivid.

How can you turn hard wire into jelly?

As you rub your hands around the wires, the gaps between the touch receptors in your skin may be 'filled in' by your brain, so it feels velvety. This is called the filling-in phenomenon. The velvety sensation tends to be felt in the between two lines or pieces of wire, rather than the entire region of your hand.

When the illusion has been tried on horizontal, rather than vertical wires, the illusion isn't as strong or consistent for many people. Similarly, a single wire tends to give a weaker illusion.

Multisensory perception exhibit: Can temperature cause surprising sensations?

When you use this hands-on exhibit…you'll touch some red and blue metal coils.

The red coils are as warm as bathwater (about 40 °C), the blue coils are as cool as ambient room temperature (about 20 °C). This doesn't sound terribly dangerous, but when you touch a mixture of warm-cool- warm-cool coils, they generate a strange stinging sensation. While this may feel slightly painful, it's only a tactile illusion and you will not be injured.

If your nervous system didn't regulate how hot or cold things can be, you could easily burn your flesh with hot or cold burns (like frostbite).

It's a fine line between pleasure and pain!

This thermal grill illusion (discovered in 1896) is still a mystery to scientists, but it seems to involve pain receptors in your skin being activated when you feel a mixture of 'safe' temperatures. Your skin is embedded with thermoreceptors that respond to either warm or cool temperatures.

You also have pain or nociceptors that respond once the temperature goes past certain thresholds (thought to be above 45 °C and below 10 °C). So, if you touch a really hot surface (say about 70 °C), your pain receptors, rather than your warm thermoreceptors, are activated.

Strangely, the mixed coils in this exhibit are set at 'safe' temperatures (about 20 °C and 40 °C), but when you touch the mixture of warm-cool coils, three types of receptors seem to be activated:

- warm thermoreceptors are activated by the warm bars,
- cool thermoreceptors are activated by the cool bars and
- nociceptors, which create the stinging sensation of pain.

If you pull your hand away as a reflex after touching the mixed coils, it's probably because your spinal cord processed and responded to the simultaneous warm-cool signals and interpreted it to be painful, before your brain was conscious of what was happening.

Audio-language exhibit: Can you forget what you've heard?

When you use this multimedia exhibit…you'll listen to different audio files.

One audio file just sounds like synthesised beeps and squeaks, but when you hear it a second time, you'll swear you can hear someone talking.

When you're trying to hear a friend talking to you in a noisy room, your brain often uses phonemic restoration to make sense of what they're saying. One part of your brain handles everyday noises while another part of your brain handles phonemes, which are units of sound in language.

These brain areas also work together, so once your language centre processes the normal sentence in the exhibit, it can't help but influence how you 'hear' words in the beeps and squeaks.

Words don't go in one ear and out the other. Sometimes they bounce between different parts of your brain.

When you re-listen to the synthesised audio files in this exhibit you cannot seem to 'unhear' the words.

Test A says: "Who drank the milk?! The carton is empty."

Test B says: "Have you been on holidays? I didn't see you last week."

Test C says: "The man's cutting some wood for the camp fire."

You probably didn't even realise that the synthesised audio file contained words when you heard it the first time.

Separate areas of your brain work together to hear and process speech. The right hemisphere of your brain processes everyday sounds like the beeps and squeaks in the synthesised audio file. However, language tends to be processed in the left hemisphere of your brain.

As you listen again to the beeps and squeaks in the synthesised audio file (after hearing the normal audio of someone saying a sentence), the sound gets diverted to the right hemisphere of your brain and it uses phonemic restoration to translate the words.

So even though your left hemisphere is processing the beeps and squeaks, the right hemisphere of your brain can't help but hear the words.

Visual perception exhibit: Look through this Hyperscope and Pseudoscope

When you use these special viewing scopes…you'll look at shapes or friends nearby and see how your sense of depth perception is enhanced, or even turned inside out!

The Hyperscope and Pseudoscope alter your stereovision, so people look strange and some things seem to be 'inside out'.

Both the Pseudoscope and Hyperscope were built by Terry Pope in the UK: www.phantascope.co.uk

What would you see if you pushed your eyeballs out sideways?

Your eyes are about 6.5 cm apart, but the:

- Hyperscope creates the illusion that your eyes are 41.5 cm apart,
- Pseudoscope creates the illusion that your eyeballs are 35.75 cm apart and your eyes have swapped sides.

This creates bizarre stereovision effects: the background becomes foreground, and the foreground recedes.

When you use the Pseudoscope or Hyperscope, your brain receives very different signals from each eye and it fuses these signals to create an image with exaggerated stereoscopic depth.

The Hyperscope can be used to study speculative geometry, archaeology (surveying), crystallography, architecture and art.

Both the Hyperscope and Pseudoscope also alter your sense of size constancy. Size constancy is how your brain judges the size of things that are nearby or far away.

When you look at something that is far away, the object projects a small image onto your retina. If the object moves closer, the image it projects onto your retina grows much larger, but your brain allows for the distance before assuming that the object is gigantic. In other words, your brain combines information about retinal images and distances to generate an idea of the real size of the object.

Visual perception exhibit: Watch the spinning spiral and see things expand

Watch the spinning disc and see things expand!

When you use this hands-on exhibit…you'll stare into a spinning disc, then quickly look at something else and notice a very strange effect.

Just as your eyes adjust from bright light to dim light when you walk into a dark cinema, your visual system also needs to adjust from watching fast motion to something more stationary.

If you stare into a large water fall in a garden, then look off to the side, you'll probably notice surrounding bushes or rocks start to 'wobble' and 'boil'. This is due to a motion after effect.

Is your world really in a spin?

A motion after effect makes things appear to 'expand' or twist, even though the things don't actually change size or move. The effect is caused by how cells represent motion in your brain, particularly in your visual cortex.

There is debate over whether the motion-sensitive cells in your brain become fatigued or not, but continuous motion in a certain direction leaves us with a bias in the other direction—an after effect.

Different cells in your visual cortex respond to movement in different directions, but the motion after effect works if you see movement in part of your visual field, rather than your whole visual field.

So when you are driving down the highway in your car, you see everything moving and you don't get a motion after effect when the car stops.

When you're riding in a train however, you only notice movement through a smaller window, while the carriage seats and walls seem to be still. When your train stops, the station platform can sometimes appear to move backwards as the motion after effect in your brain continues while your motion cells are resetting.

Multisensory perception exhibit: Can you see what I'm saying?

Your brain often combines sensory clues to work out what's going on.

Have you ever tried to listen to a fellow diner in a noisy restaurant and noticed that you had to watch their lips to try and understand what they were saying? In a noisy restaurant, you often combine two senses (hearing and vision) to work out what's being said (language processing). Usually, this works out well. Sometimes, it doesn't work out so well, as you'll discover if you try this test and see what other people think they heard too.

Sometimes, what you hear can be affected by what you see, but usually when we watch someone speaking, the sounds they make match their lip movements.

When the two sensory signals differ (like seeing "ga ga" lip movements but hearing "ba ba"), your brain fuses the signals together as best as it can and assumes you're hearing "da da".

The McGurk-MacDonald Effect only works for certain phonemes including "ba-ga" and "pa-ka", (which you hear as "ta"). When the effect occurs for these phonemes, sensory information is combined or integrated pre-consciously before language processing occurs in your brain.

Audio-language exhibit: Can words be shaped?

If you're in a shop comparing identical knives, which brand would 'feel' more knife-like: the 'taluma' knife or the 'takete' knife? 'Takete' tends to sound more knife-like to most people, but why?

The Kiki/Bouba Effect test was developed by German-American psychologist Wolfgang Köhler in 1929. In this test, people were shown two shapes: one a jagged shape, the other a rounded 'blob' type shape, together with two words 'Kiki' and 'Bouba'. When people were asked to name the shapes, they call the jagged shape 'Kiki' and the rounded shape 'Bouba'. Even when this Kiki/Bouba test has been used with people who spoke different languages, 90 to 98% of them picked the jagged shape as 'Kiki', and the curvy shape as 'Bouba'.

For many people, 'Kiki' sounds sharp and explosive and 'Bouba' sounds rounded and soft. This is called **sound symbolism** and is an example of how your brain can assign qualities to shapes, sounds, colours and numbers.

The sound of certain vowels and consonants can feel explosive and they tend to evoke sharp and dynamic concepts. The taut shape of your mouth and tongue when you say consonants such as 'k', 't' or 'p' may also influence how you feel about the sounds.

Soft-sounding consonants and vowels such as 'oo'and 'ah' often seem soft and friendly to people. When you say 'Bouba' your mouth also tends to make more rounded shapes, which may influence how you feel about the sound too.

Companies and advertising agencies sometimes use sound symbolism and the perceived meaning of words to give their products a certain image.

For example, names for a smart phone were tested many years ago. They eventually agreed on calling the smart phone BlackBerry® because (researchers believed):

- the keyboard (on that particular model) looked like berry seeds,
- the 'k' makes it sounds dynamic and
- 'b' sounding names are often perceived to be reliable.

'Blackberry' also creates the impression of a highly connected network like a blackberry bush.

Audio-language exhibit: Can you make up a memory?

Sometimes when we try and remember things, our brains invent details. This may be because your brain is trying to fill in missing gaps of information, or because of the way our brain compares concepts when ‘rustling’ around your neural networks to retrieve memories.

Read aloud this list of words ONCE to memorise them.

thread, pin, eye, sewing, sharp, point, prick,

thimble, haystack, thorn, hurt, injection,

syringe, cloth, knitting

Right, now here’s your test.

Cover this list of words and tick off the words in the list below that you **remember** being on the list above (don’t just guess). Some of these words **weren’t** on the list you memorised, so be careful.

cheese, knitting, sharp, thimble, pin, thorn,

eye, needle, injection, green, round, point,

cloth, blood, prick, syringe, mouse, sewing,

thread, haystack, shoe, hurt, biscuit

People often insist that they remember ‘needle’ being on the list, even though it’s not! This is because their brain created a ‘false memory’. Memory failure isn’t just about forgetting someone’s name or forgetting what you wrote on a lost shopping list. Memory failure also includes **fabricating** false memories such as fooling your recall of an event and filling in details that kind of match the situation.

When people ‘create’ a memory like this, the process is called DRM (the Deese/Roediger/McDermott paradigm). Scientists are still discovering how we store and retrieve memories, but we know that our brain doesn’t store discrete amounts of information like a video library. Instead, memories seem to be represented in the brain as networks of related concepts. One hypothesis is that a healthy memory system copes with massive amounts of information by forming connections between concepts based on associations we’ve developed through experience.

Then, when we’re trying to remember a piece of information, our brain either pulls up an assortment of associated concepts which ‘feel’ right, or our mental networks are structured to generate associations which ‘feel’ right.

While being able to invent memories may seem like fun, it can impact on witness statements about an accident or a crime. Marketers on the other hand can take advantage of the way we create memories and associations. They often use suggestion or inference in their advertising to persuade customers to buy products without the customer having to remember specific details.

Multisensory perception exhibit: Do you really see what you hear?

Sometimes, what you hear can influence what you 'see'.

If a rabbit image is flashed on the screen while you simultaneously hear a different number of beeping sounds for each test. We assume that our eyes and brain see exactly what is around us, but this test shows how sound can influence what you think you're seeing.

Hearing tends to dominate when we're trying to work out the **timing** of something. So, if you see a dot flash once on a screen, but hear two beeps at the same time, your visual system is influenced by your audio system, so your brain assumes the dot flickers twice, not once.

Vision tends to dominate when we're **locating** the source of a sound. When you're watching a lecturer on stage and hearing their voice being broadcast from surrounding speakers, you still believe the voice is coming from the lecturer's mouth.

This sound-induced flash illusion shows how regions of your brain can combine sensory signals before the signals are processed further.

Visual perception exhibit: Does brightness change how you see speed?

If you see a person jogging through thick fog or at dusk, they may seem to drift slowly towards you, whereas when you see the same jogger in bright sunlight, they seem to move more quickly.

If you're trying to judge how fast something is moving, it often depends on how bright the thing appears against its surroundings.

This illusion was discovered by Dr Stuart Anstis, University of California, San Diego.
http://anstislab.ucsd.edu/2012/11/19/footsteps/

The yellow (light) and blue (dark) squares *always* move together at the same speed, regardless of the background.

The squares *appear* to move like stepping feet because they contrast so strongly against the black and white stripes.

Detecting motion and speed is particularly strong in your peripheral vision and it's easier to notice things in your peripheral vision if they contrast strongly. Low contrast patterns generally produce a weaker response in the motion-sensitive parts of your brain.

When the blue (dark) square passes over a white stripe, they contrast strongly against each other and the blue square appears to speed up. As the blue/dark square passes over a black stripe there is low contrast between the two and the square appears to slow down.

Visual information is eventually processed by the visual cortex in your brain, but some pieces of information are processed along separate pathways before reaching your visual cortex.

One pathway is motion-sensitive (and is stimulated first) and the other pathway is colour-sensitive. This colour information is added into the visual cortex movement has been processed.

It all happens so quickly, you don't notice the lag between each network.

Visual perception exhibit: Can you saturate your eyes?

When you see a 'ghost' image following a camera flash, it's a little similar to the after effect images you see after staring at the 'strange' pictures in this exhibit. Both are effects caused by overstimulating receptors or cones in your eyes' retinas.

The 'strange' pictures in the exhibit are digitally altered so they're inversely coloured. When you mix a colour with its inverse colour you get white. When you stared at red patches in one of the 'strange' pictures, certain cones in your retina underwent chemical responses and sent signals to your brain which it interpreted as "I'm seeing red". But because you kept staring, the cones became overstimulated and less sensitive to the red.

Then, when your overstimulated receptors see white in the black and white picture, they sent a signal to the brain about white, minus the colour that overstimulated them in the first picture (such as red).

This is interpreted by your brain so it sees the inverse colour (such as green for the red over stimulation).

Your brain thinks it's looking at those inverse colours until the receptors settle back down to normal and you see the second picture for what it really is—black and white.

Visual perception exhibit: Does the red spot shrink or change colour?

Strange things happen when you focus on the black cross and keep staring into the red spot in this exhibit. This is a tricky one – different people see different things!

For some people, the red spot fades away completely until they only see green, while others may see a yellow halo around the red spot.

Usually when your eyes make tiny, jittery saccades (up to five per second), receptors in your retina are constantly refreshed with new information.

But when you're strongly staring at the red spot, your receptors don't get refreshed as much as they usually do and they start to get fatigued.

Also, the red spot has a fuzzy edge instead of a black lined edge or border.

Because the edge is fuzzy instead of sharp, your eye can't distinguish between the red and green areas as well as it normally can. If the dot had a distinct border, your receptors could be refreshed with information about the border as well as the colours.

In fact, your visual system seeks out borders or edges all the time. But because it can't detect any borders, your brain 'fills in' the gaps and you start to 'see' things that aren't there.

Visual perception exhibit: Do you see bumps or dents?

How can shadows shift shapes?

The placement of shadows can affect how we interpret a picture.

Our brain does a lot of analysing in the background which we often don't notice until we see an illusion or a test like this.

Even simple clues like the placement and angle of shadows are automatically processed by your brain so you know the depth of a hole, or the height of a bump.

In fact, shadows are one of the first things our visual system processes when we're trying to work out the shape of something.

Your brain is hard-wired to guess that light comes from the top of your visual field which doesn't mean that it calculates where the Sun is positioned in the sky.

Even when your *head* is turned upside down and you look at the picture in its normal upright position, your brain assumes that light falls from the top of your *visual field* rather than from the sky above. So anything that looked like a bump when your head was upright continues to look like a bump when your head is upside down (while the dents still look like dents).

This also indicates that your visual system doesn't pay attention to signals from your vestibular system when you're trying to work out the shape of something from its shading.

However, when your head is the right way up and you turn the *picture* upside down, the shadows change position, but your brain still thinks that light is shining from the top of your visual field. So according to your brain, bumps turn into dents and dents turn into bumps.

Our ancestors generally kept their heads upright, so our brain can get away with this simplified shortcut that light could be analysed 'top down' in your visual system.

Visual perception exhibit: Are the long lines tilted or parallel?

What part of the Zöllner illusion causes the effect? (The illusion's effect is seeing the long diagonal lines tilt slightly so they look as though they're angled towards each other instead of being parallel.)

Scientists are unsure why the Zöllner illusion works, but the short angled lines on top may fool your perception of depth and size constancy.

If a friend runs towards you, the image they project onto your retina becomes larger, but your brain interprets this as your friend getting closer to you, instead of them becoming a giant (or getting smaller if your friend runs away). This is **size constancy**.

Your brain also judges the size of things against the angles of a horizon or room corners, which is possibly what your brain is trying to do with the lines of this illusion.

Oddly, if you see the Zöllner illusion in red and green, instead of black and white, it seems to weaken the illusion.

Social perception exhibit: Which face is more likeable?

There are a lot of cues we take notice of when deciding if someone we're looking at seems friendly or not. We unconsciously analyse faces and each person tends to judge faces a little differently.

However, some characteristics are universally perceived to be more friendly or appealing than others, such as:

Direct eye contact,

Even across cultures, people seem to prefer faces where the other person's gaze is directed towards the viewer, rather than off to the side. In an Aberdeen (Scotland) study, several hundred men and women selected faces looking straight at them as being more likeable, even if the faces looked disgusted instead of photos of people who were looking away.

Dilated pupils

Dilated pupils can indicate that a person feels pleasure because they see something or someone they like. Even cartoon characters are drawn with large, dilated pupils to make them appealing and unthreatening.

Whether a smile appears to be 'real or fake'
Sometimes it's difficult to judge whether someone's smile is genuine or not, but we often subconsciously judge a smile and favour genuine smiles over fake smiles.

Social perception exhibit: Which face is ‘normal’?

We can instantly judge whether a face is male, female, happy, angry, older or younger. But strangely, when a face is turned upside down (inverted), we seem to lose the ability to judge even the simplest things such as facial expressions.

Scientists are unsure why faces that are digitally manipulated seem to appear so normal when they’re upside down (or inverted).

When faces are the right way up, we ‘understand’ faces as a whole based on their internal components. This is called judging the face holistically.

But when you look at an inverted face, you seem to lose the ability to process it holistically. Instead, you analyse individual features (eyes, nose and a mouth), which makes it harder to detect that something is wrong with the inverted face.

This is often called The Thatcher Illusion or Effect, because a photo of former British Prime Minister Margaret Thatcher was manipulated by Peter Thompson of the University of York in England.

This effect may not cause a problem in every day life because really, how often do you need to judge upside down faces?!

The area of your brain that’s active when you analyse upright faces is the fusiform facial area, which borders your brain’s temporal and occipital lobes.