

Primary Science & Technology *Bulletin*



Ideas and inspiration for teachers in Primary Schools and S1/S2

- > Health & safety on farm visits
- > Seeing is believing
- > SSERC CPD courses

Health and safety on farm visits

A new industry code of practice *Preventing or controlling ill health from animal contact at visitor attractions* now replaces previous advice from Scottish Government, Health Protection Scotland and HSE.

Farm visits can be of significant educational value. They allow pupils to see at first hand where their food comes from (the so called 'farm to plate' message), consider issues such as care, respect and welfare of living things and to experience risk assessment in a real life setting.

Advice on Health and Safety during school visits to farms is provided by the Scottish Government [1]. However the sources of advice to which that guidance refers have now been deleted from the Scottish Government website as it has been from the Department for Environment, Food and Rural Affairs (DEFRA) and Health and Safety Executive (HSE) websites. Suitable advice on these matters (*Preventing or controlling ill health from animal contact at visitor attractions: industry code of practice version 2*) is available from the Farm Visits section of the RHET website [2].



All animals naturally carry a range of microorganisms, some of which can be transmitted to humans, where they may cause ill health. It is uncommon for visitors to farms or other animal attractions to become ill as a result of their visit. The transmission of harmful microorganisms from animals to humans is most commonly through the hand to mouth route from contact with animal faeces or saliva. Thus the control measures to prevent transmission depend on breaking the transmission pathway by: maintaining a clean site to avoid contact with faeces, preventing contact with animals (by double fencing for example) and by effective hand washing and hygiene (Figure 1).

Where there are specific controlled areas where animals may be handled or fed, the principle control measure to prevent transmission is effective hand washing/hygiene. Here soap, running water and disposable paper towels is the preferred means of hand washing. Wipes and hand gels are **not** an acceptable substitute for proper hand washing. Young children may require close supervision or assistance during hand washing to ensure it is carried out in a hygienic manner. Young children may also require sufficient supervision to ensure they avoid hand to mouth contact while having intentional contact with animals. It should be borne in mind that *E. coli* 0157 (a microorganism that may be found in farm animals) is particularly serious in children under 5 years.

As with many other educational or recreational activities, visits can never be considered free from all risk. However, while the hazards are real, the risk of infection in children can be readily controlled by simple everyday measures. In Scotland it is wise to arrange such visits through the Royal Highland Educational Trust (RHET) Countryside Initiative Project Coordinator [2]. Even if you have a local farm happy to accommodate a school visit it would be wise to arrange for the farmer and RHET to make contact to ensure that suitable arrangements are put in place for a visit. RHET works with volunteer farmers to facilitate free, fully risk-assessed Farm Visits.

There is a shared responsibility between the farmer or visitor attraction and the visiting school for risk assessment. Although the host farm or attraction will put control measures in place, it is important that the teacher knows what they are, judge if they are suitable based on the Industry Code of Practice, and inform, instruct and supervise children so that they comply with the control measures. If a farm visit is arranged through the local RHET coordinator, a pre-visit 'walk through' of the visit will be arranged where risk assessment can be discussed along with the desired educational outcomes for the visit. Further details are available through the RHET web site [2].



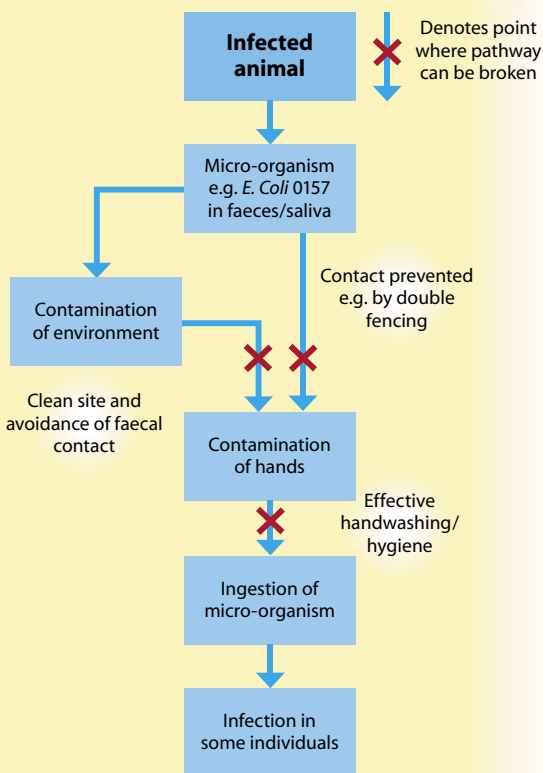


Figure 1 - Risk pathway for micro-organisms.

Before your visit, you should:

- Read and understand the advice in the industry Code of Practice, and discuss arrangements for the visit with the management at the site.
- Confirm that the control measures provided at the site match the recommendations in the industry Code of Practice.
- Seek advice from your local authority/employer on what the appropriate ratio of pupils to teachers/adults should be.
- Discuss and agree with staff/parents/helpers their roles and responsibilities during the visit. In particular, they must understand the need to make sure that the children wash, or are helped to wash, their hands thoroughly after contacting animals and before eating.

Key points to cover with the children should include:

- Explaining the rules for the visit, stressing that they must not eat, drink or chew anything (including sweets) outside the areas in which you permit them to do so.
- Explaining why they must wash their hands thoroughly after contact with the animals, and before eating or drinking anything.
- Demonstrating how to wash their hands properly.
- Discussing the requirements for appropriate clothing, including suitable footwear. Sandals are not suitable and Wellingtons may be required (or supplied).
- Checking that cuts, grazes etc. on children's hands are covered with a waterproof dressing.

During and after the visit, make sure that the children:

- Are reminded of the rules/ precautions to take upon arrival at the site.
- Do not kiss animals.
- Always wash their hands thoroughly before and after eating, after any contact with animals and again before leaving the site.
- Eat only food that they have brought with them or food for human consumption that they have bought on the premises, in designated areas.
- Never eat food that has fallen to the ground.
- Never taste animal foods.
- Do not suck fingers or put hands, pens, pencils or crayons etc. in mouths.

- Where practical and possible, clean or change their footwear before leaving. Facilities may be provided for this e.g. disinfectant footbaths.
- Wash their hands after changing their footwear.

Check that the children stay in their allocated groups during the visit, and that they:

- Do not use or pick up tools (e.g. spades and forks) or touch other work equipment unless permitted to do so by site staff.
- Do not climb on to walls, fences, gates or animal pens etc.
- Listen carefully and follow the instructions and information given by the site staff.
- Approach and handle animals quietly and gently.
- Do not chase, frighten or torment the animals.
- Do not wander off into unsupervised or prohibited areas e.g. manure heaps.

Remember the children are your responsibility during the visit:

- You should supervise them during the visit, especially during hand washing to make sure that each child washes thoroughly. Site staff may be able to help with this supervision.
- Allow plenty of time for hand washing before eating or leaving the site so that the children do not have to rush.

References

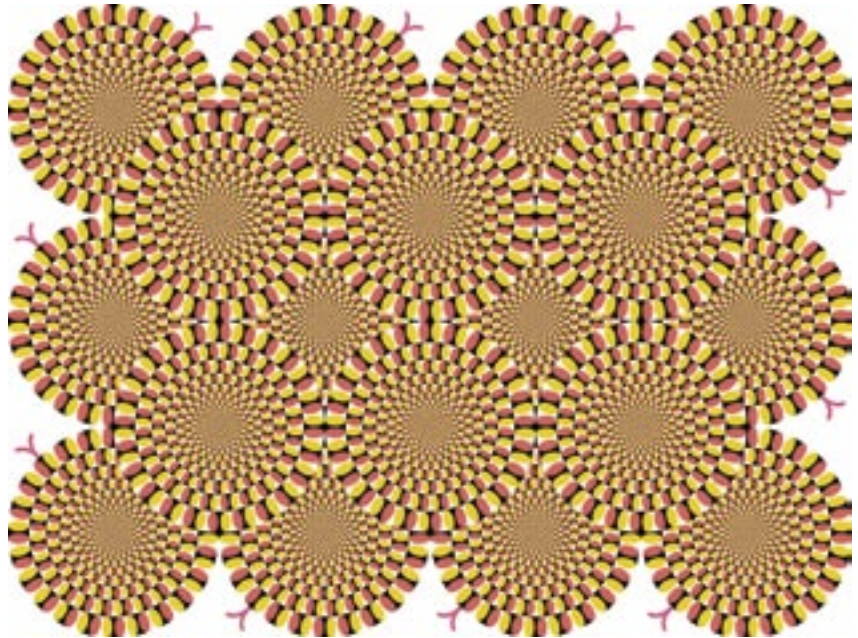
- [1] Health and Safety on Educational Excursions - Farm Visits, The Scottish Government, 2004. Available at <http://www.scotland.gov.uk/Publications/2004/12/20444/489523> (accessed 17th June 2013).
- [2] Farm Visits, The Royal Highland Education Trust. Available at <http://www.rhet.org.uk/Teachers/Farm+Visits> (accessed 17th June 2013).

Seeing is believing

Optical illusions are a fascinating and engaging way to encourage learners to explore the links between our senses and the environment.

Learners may already be aware of the existence of optical illusions, as they have long been used in art, design and advertising (Figure 1). Famous artists, such as M. C. Escher, produced artworks involving “impossible” objects, buildings and images - designed to both intrigue and baffle the observer [1].

Learners may not be aware of the different types of optical illusion and how each succeeds in “tricking” the brain. A focus on optical illusions can provide an opportunity for research into the senses and provides a chance to experience our limitations in interpreting the



An optical illusion similar to Rotating Snakes by Akiyoshi Kitaoka, drawn by CMG Lee (sourced from Wikipedia). This illusion of motion is based on the work of Akiyoshi Kitaoka - Professor of Psychology at Ritsumeikan University, Japan. Contrast in colour and brightness along with the small jerky movement of our eye muscles combine to produce this amazing illusion.

world around us. The activities described could help to support the delivery of the following *Curriculum for Excellence* experiences and outcomes in the sciences [2]:

Biological systems: Body systems and cells

I can identify my senses and use them to explore the world around me - *SCN 0-12a*.

I have explored my senses and can discuss their reliability and limitations in responding to the environment - *SCN 1-12b*.

I have explored the structure and function of sensory organs to develop my understanding of body actions in response to outside conditions - *SCN 2-12b*.

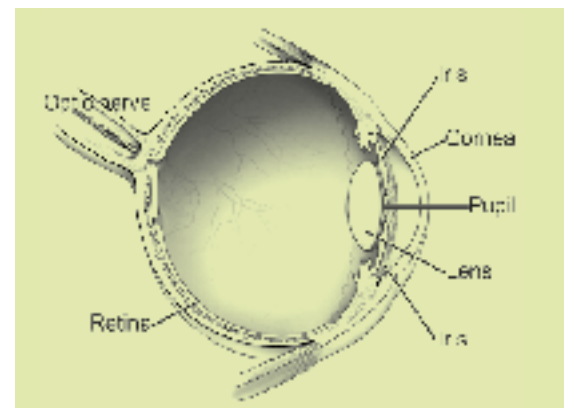


Figure 2 - Image: National Eye Institute, National Institutes of Health (Ref#: NEA08).

The phrase “seeing is believing” is often used - but can we really believe our eyes? The difference between what is real and what is experienced all comes down to perception - this relates to all senses but in this article we deal with perception related to vision.



Figure 1 - Design by Victor Vasarely situated in Pécs, Hungary. Photograph by Várad Zsolt (Source Wikipedia).

Learners are encouraged to explore the structure of sensory organs and may be aware of the external features of the eye. A study of the internal structure of the eye (Figure 2) and opportunity to discuss how objects are seen may reveal misconceptions surrounding light and the way the eye works. A number of misconceptions are often commonly held by learners - often learners think that light is "beamed out" or somehow produced by the eye and directed at an object, thereby allowing it to be seen. Learners should be given the chance to explore these misconceptions and investigate the ways in which light is produced, travels and is reflected. Active Assessment/Concept Cartoons™ [3] are available to support the identification of misconceptions and assist with practical ideas and explanations to help learners understand the concepts behind a number of scientific processes. A BBC Learning Zone video clip detailing the main internal parts of the eye is also available online [4]. At secondary school learners may be given the chance to dissect a mammalian eye to further enhance their understanding of the structure of this complicated organ - SSERC Secondary Bulletin 241 [5].

Light entering the eye reaches the sensitive cells of the retina, located at the back of the eye, electrical signals are generated and sent to the brain via the optic nerve. Due

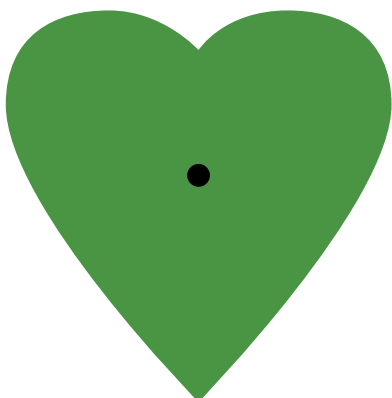


Figure 3



Figure 4 - Colour wheel showing complementary colours opposite each other.

to the way light passes through the cornea, pupil and lens of the eye the image is actually formed upside down on the retina and one of the functions of the brain is to re-invert this image. However, what the brain interprets and what we actually "see" is also shaped and strongly influenced by learning, memory and expectation and these discrepancies between reality and perception lead to the existence of some optical illusions.

Colour illusions

One of the easiest optical illusions to make and try out is based on the illusion of after-image. Stare straight at the black dot in the centre the green heart (Figure 3) for around 30 seconds - now transfer your gaze to the white area next to the image.

What did you "see"? Most people see an after-image on the white background; the green heart

"replaced" by a red heart - the black dot in the centre may also now appear white. This might take a bit of practice - ensure the image is well lit and that you look intently at the image for at least 30 seconds.

To explain this illusion this we need to look the internal structure of the eye again (Figure 2). The retina contains millions of light sensitive cells, some called rods and some called cones. It is the cones that are sensitive to coloured light. Each cone in the human eye is sensitive to either red, blue or green light. Using signals from these receptors the brain is able to allow us to perceive the myriad of colours that surround us.

The colour of the after-image produced is dependent upon complementary colours shown on the colour wheel (Figure 4). Learners will notice that the colour of the after-image they experience is the one opposite the colour of the original image. Each individual may perceive differences in the after-image colours and this is an area of on-going research by neurologists. Both Isaac Newton [6] and Johann Wolfgang von Goethe [7] researched colour theory and learners may be familiar with Newton's Wheel [8] demonstrating that white light is in fact made up of a spectrum of colours. In the same way the effect of a rainbow is caused by drops of water in the atmosphere splitting sunlight into its constituent colours.

When you looked at the first image of the heart it appeared green. This is because the image absorbed all the colours in the white light *apart* from the green light which it reflected. This reflected light reached the retina of the eye where it excited the cones, causing your brain to perceive the image as green. ►

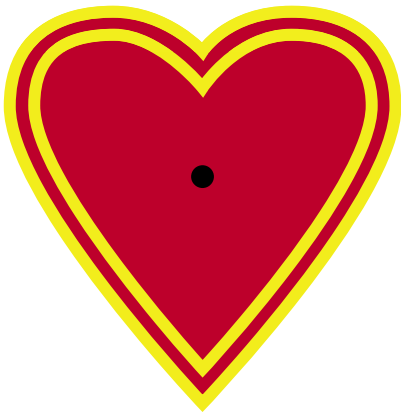


Figure 5

As you stare at the image the light sensitive cones continue to respond, triggering electrical signals to the brain. After a time, however, the cones that are most stimulated stop responding so well. Now when you transfer your gaze to the white area light (of all colours) is once again reflected from the surface and reaches your retina, however the fatigued cones are unable to respond - so the green part of this white light is not now perceived. It is the white light with the green part removed - which our brain perceives as red - which produces this remarkable effect. Most after-images only last a few seconds as the cones quickly readjust.

It is thought that the brain has learned to phase out constant unchanging images in order to recognise new or moving images, which may be of potential threat or interest, and this goes some way to explain the phenomenon of after-image illusion. Learners can use technology, coloured paper or paints to produce their own after-image illusions exploring which colours are complementary and making predictions based on knowledge of complementary colours. For instance what colours will the after-image illusion be for Figure 5?

Eric Carle's book "Hello Red Fox" [9] is based on this concept and is an engaging book on which could be based a number of art and literacy activities. Learners might enjoy producing and sharing their own storybook, perhaps for younger children.

The phenomenon of the after-image illusion explains why surgeons and staff wear green or blue clothing in operating theatres - focusing on an open wound for long periods would lead to after-images if the surrounding fabrics and clothing were white.

Other optical illusions to try

Distortion illusions

Look at figure 6 - Which horizontal line is longer?

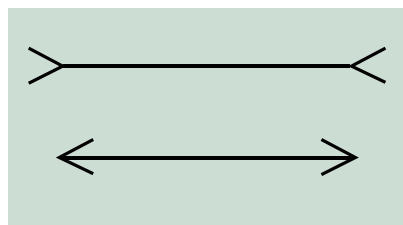


Figure 6 - Muller-Lyer illusion.

This illusion was identified by Franz Muller-Lyer in the nineteenth century and is named after him.

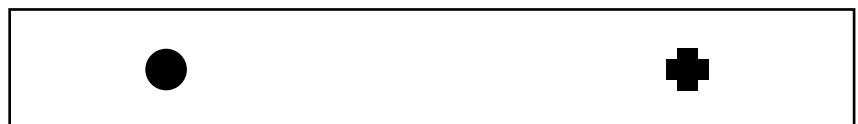


Figure 8 - The blind spot.

Learners may have to resort to measuring each line carefully before they "disbelieve" their eyes! This illusion is caused by the angles formed by the outer lines of each image. We perceive the converging angles in the bottom picture to contain a shorter segment whereas the diverging angles appear to frame a longer segment. This type of illusion can be easily produced by learners and many more examples can be created by them quite simply using copy and paste or pen and ruler (Figure 7).

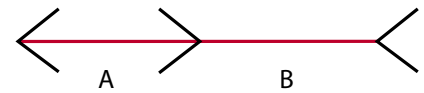


Figure 7 - Which red line is longer A or B?

The blind spot

Cover your right eye and focus on the black cross with your uncovered left eye. Bring the page to within 10 cm of your eyes now move the page (or your head) away slowly. Continue to focus on the black cross, at a distance of around 25 cm the black dot should "disappear" from view - the actual distance varies from person to person. Try swapping the hand and eye over and repeat, this time focusing right eye on the black spot.

To explain this we need to look again at the diagram of the eye (Figure 2). This "blind spot" is the area on the retina where the optic nerve leaves the eye. There are no rods or cones to detect light here so therefore no image formed - however in everyday life a combination of constant change of perspective, eye movement and psychological processes compensate for this.

There are many more examples of optical illusions... look out for a future SSERC bulletin article with even more practical ideas for use in the primary classroom.

A number of other CfE curricular areas could link with the activities outlined [1]:

Expressive arts

I can create a range of visual information through observing and recording from my experiences across the curriculum - EXA 0-04a/1-04a.

Through observing and recording from my experiences across the curriculum, I can create images and objects which show my awareness and recognition of detail - EXA 2-04a.

I can respond to the work of artists and designers by discussing my thoughts and feelings. I can give and accept constructive comment on my own and others' work - EXA -07a.

Technologies

I am developing an interest, confidence and enjoyment in using drawing and colour techniques, manually or electronically, to represent ideas in different learning situations - TCH 1-15a.

I can use drawing techniques, manually or electronically, to represent objects or ideas, enhancing them using effects such as light, shadow and textures - TCH 2-15a.

References

- [1] <http://www.mathacademy.com/pr/minitext/escher> (accessed 12th July 2013).
- [2] <http://www.educationscotland.gov.uk/thecurriculum/howisthecurriculumorganised/experiencesandoutcomes/index.asp> (accessed 12th July 2013).
- [3] <http://www.millgatehouse.co.uk> (accessed 12th July 2013).
- [4] <http://www.bbc.co.uk/learningzone/clips/the-eye-and-how-it-works/1626.html> (accessed 12th July 2013).
- [5] <http://tinyurl.com/sserc-i> (accessed 12th July 2013).
- [6] http://www.ehow.com/about_5101113_newtons-theory-color.html (accessed 12th July 2013).
- [7] http://www.ehow.com/about_5339812_goethes-color-light-theory.html (accessed 12th July 2013).
- [8] <http://www.nationalstemcentre.org.uk/elibrary/resource/3331/newton-wheel> (accessed 12th July 2013).
- [9] <http://www.eric-carle.com/bb-HRFnotes.html> (accessed 12th July 2013).

Sources for further research

Visits

- Camera Obscura and World of Illusions - Edinburgh
http://www.camera-obscura.co.uk/camera_obscura/camera_obscura.asp (accessed 15th July 2013).

Publications

- Optical Illusions by Inga Menkhoff (Published by Parragon)
http://www.books.google.com/books/about/Optical_illusions.html?id=oiNWXQheqUC (accessed 15th July 2013).
- Usborne 50 Optical Illusion Cards <http://www.seeinside.usborne.com/default.asp?id=3900&site=4> (accessed 15th July 2013).

Websites

- http://kids.niehs.nih.gov/games/illusions/lots_of_illusions.htm (accessed 15th July 2013).
- <http://www.sciencekids.co.nz/pictures/illusions.html> (accessed 15th July 2013).

Important changes to the SSERC website

The normal procedure for logging into the SSERC website is about to change. We are moving away from the generic Member/XTZA5010 combination.

To continue being able to access www.sserc.org.uk you will need to be issued with your own username/password combination. To obtain your personalised log-in username and password combination email us at registration@sserc.org.uk.



Please make sure that you use a recognisable school email address and include your full name so that we are able to update our database.

Join us for a SSERC CPD course...

We are running a number of exciting CPD events during this session - all focussing on practical ways in which to enhance teaching and learning in science and technology. A number of our courses are residential and are based at SSERC in Dunfermline. With lots of hints, tips and resources to take away these events are not to be missed.

Residential courses

Coming up is "Science Rocks Our World" a 3 day residential course (21st - 23rd November) exploring aspects of Space, Processes of the Planet and Biodiversity.

Following the success of last year's course for NQTs we are running a similar 2-part course (31st January - 1st February & 12th May 2014). This time we are opening the course to applications

from early career teachers as well as NQTs and Probationers. The course will focus on some of the "big ideas" in science and will provide opportunities for participants to take part in a range of practical workshops and discussion activities which will transfer directly to the classroom. Between Parts 1 and 2 of the course participants will be asked to carry out a "Gap Task" back at school and share what they have done with other course members on their return to Part 2.

Local Authority schools and FE colleges will be entitled to receive an ENTHUSE funded grant (administered through the National Science Learning Centre) on completion of these residential courses.

SSERC interactive Glowmeets

If you would like to take part in practical science activities, alongside your colleagues, without leaving school then our innovative range of CPD - delivered via Glow - might be just what you are looking for. We have developed three Glowmeets for this session: Fun with Forensics, Microorganisms and Sound. Each Glowmeet is held as a twilight session, is free to attend, and is fully resourced via a kit box delivered to your school. Schools need to submit an application form for each event and, if selected, will receive a resource box and be granted access to the SSERC Glowmeet.



Only 20 places are available on each of our courses, and the closing dates are soon, so make early application to join us!

To book on-line go to www.sserc.org.uk click on CPD and select Primary from the CPD Menu.