Thermal imaging is cool

For the last three or four years, we have been showing teachers how to convert webcams to "see" into the infrared.

There are a good number of engaging activities that can be carried out with these devices, but we always ended up telling teachers that they won't pick up the radiation emitted by a person because its frequency is too low for a silicon sensor. "For thermal imagery," we'd say, "you need something costing thousands of pounds."

Now, we'd tell them something slightly different. The FLIR i3 (Figure 1), at £895 ex VAT, is not a device we'd dare describe as cheap when we know that some departments have around a tenth of this left from budgets after photocopying, but it is relatively inexpensive.

Figure 1 *- FLIR i3 thermal imaging camera.*

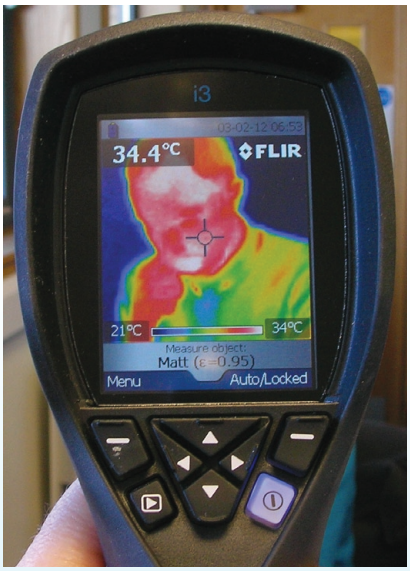


Figure 2 *- FLIR i3 screen.*

The i3 has a sensor called a microbolometer. Simplistically, each pixel is a resistance element that is highly sensitive to temperature. We are not talking megapixels here - our FLIR has a resolution of 60 x 60 pixels, or 3.6 kilopixels. It is sensitive to temperatures from -20 °C to 250 °C. Thus it covers body temperature and the temperature of one's surroundings. The camera displays images on a 2.8 cm LCD screen (Figure 2) and can take pictures on to a supplied memory card. It cannot be hooked up to a monitor to give large, real-time images. The i3's field of view is 12.5°. It can spot meter temperatures and claims an accuracy of ±2% or ±2 °C. Its image refreshes 9 times per second and the user can select from three different colour palettes. Reassuringly, it has been tested and found to be able to survive a drop of 2 m.

So what could it be used for? The obvious suggestion is to use it to look at heat loss from buildings (Figure 3), though children would need some help in interpreting results - for example, glass is opaque to this wavelength range.

We could also look at people (Figure 4) and discuss the use of thermal imaging in search and rescue and health care. Our tester climbed into a rubbish bag and was still visible to the FLIR i3.

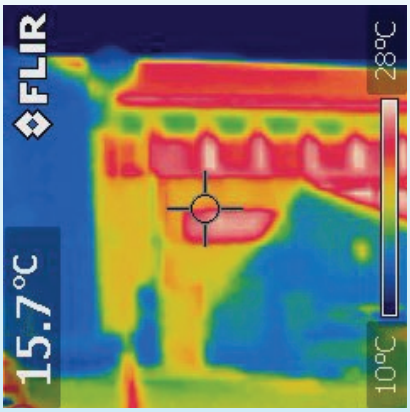


Figure 3 *- Which parts of our new building are not well-insulated?*

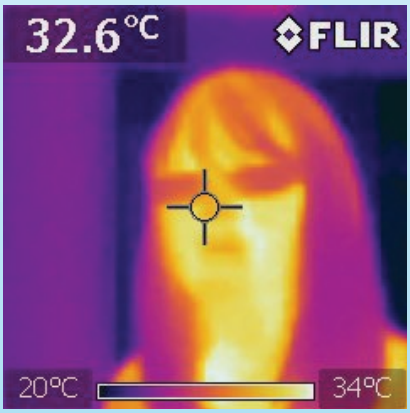


Figure 4 *- Is this the coolest person working at SSERC?*

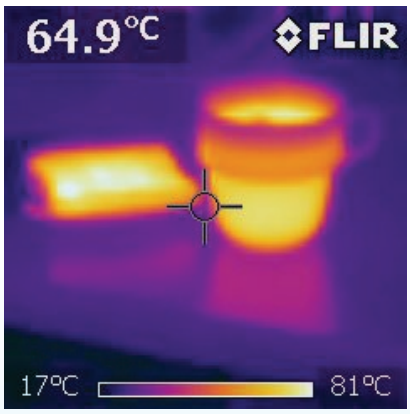


Figure 5 *- Tea and toast.*

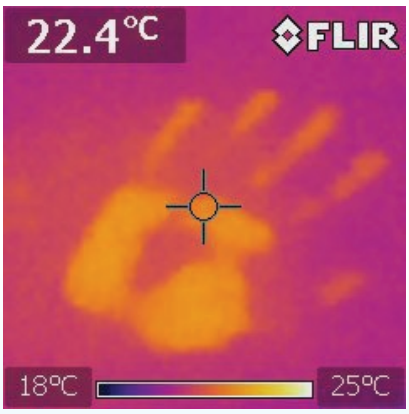


Figure 6 *- Hand print.*

Figure 5 shows some tea and toast. Children could design insulating containers for food or investigate the insulating properties of different materials by wrapping them around bottles of warm water.

Figure 6 is a hand print left by briefly touching a surface. Figure 7 shows friction heating caused by scuffing a foot on a carpet.

Figure 8 shows a car that has just stopped after a fair-sized drive. Note the warm tyres and hot brake discs. Note also that figures 3 and 8 use a different colour palette to that in figures 4, 5, 6 and 7.

And now to a matter of some delicacy and a series of tests, the story of which, like Sherlock Holmes' tale of the Giant Rat of Sumatra, the world is not yet prepared. Boys of school age, when given a thermal imaging camera, are going to sooner or later point it where they shouldn't. Our trials revealed nothing embarrassing. Whilst they were not extensive, you will understand our reluctance to use the phrase "small sample size." Our FLIR i3 came from Data Harvest [1]. We are considering lending it out to schools if they work with us to ensure its safe uplift and return.

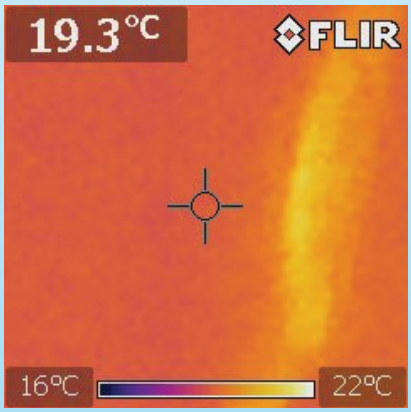


Figure 7 *- Friction heating of a carpet.*

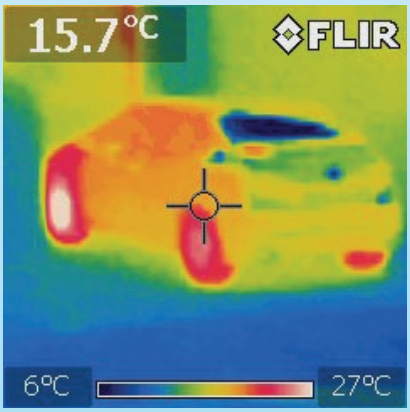


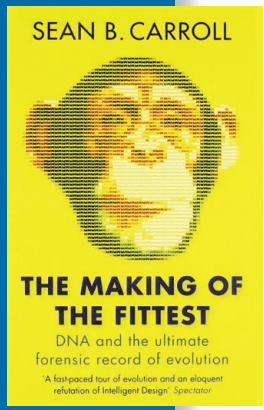
Figure 8 *- Warm tyres and hot discs.*

Reference
[1] www.datataharvest.co.uk

Book review

This is the first of what is planned to be an occasional series of reviews of 'popular science' books in biology. As a result of the new areas of biology that have been introduced to the revised and *CfE* Higher Biology, Higher Human Biology and Advanced Higher Biology courses these books can provide teachers with useful background to the new science they will encounter in these courses. Pupils can also be introduced to these books to extend their personal learning.

The Making of the Fittest - DNA and the ultimate forensic record of evolution by Sean B Carroll, Quercus, London, 2009.



This book is based on genomics and as such it relates well to the *DNA and the Genome* Unit of Higher Biology and the *Human Cells* unit of Higher Human Biology. It is also relevant to the *Organisms* and *Evolution* Unit of Advanced Higher Biology. The chapters in the book follow a theme and written in an essay type style making them suitable for reading in isolation or for using as excerpts to support lessons. Good use is made of interesting examples that illustrate the theory and could be used as mini case studies for pupils. Overall the text is accessible enough in style for students.

A fuller and more detailed review is available on the SSERC website (www.sserc.org.uk).