Heat and light

Joseph Giacomin explains the science, and art, of thermal imaging

Early pioneer Henry Fox Talbot used the phrase "the pencil of nature" to describe photography's ability to capture even the minutest details of a scene and to draw attention to them. Whether it is the haystack he photographed in 1844 or the rubble of Nagasaki photographed by Yosuke Yamahata in 1945, photography puts us in a place, at a point in time, and brings something to our attention. I feel that thermal photography shares this defining characteristic with all other forms of photography, differing only in the greater emphasis on matters of heat and energy.

Thermal photography is the capturing of the thermal radiation emitted from objects in proportion to their temperature. Engineers use it to measure things such as the spread of temperature in a machine, or the loss of heat from a building, but it produces images that are becoming more familiar to us, all through advertising and the media.

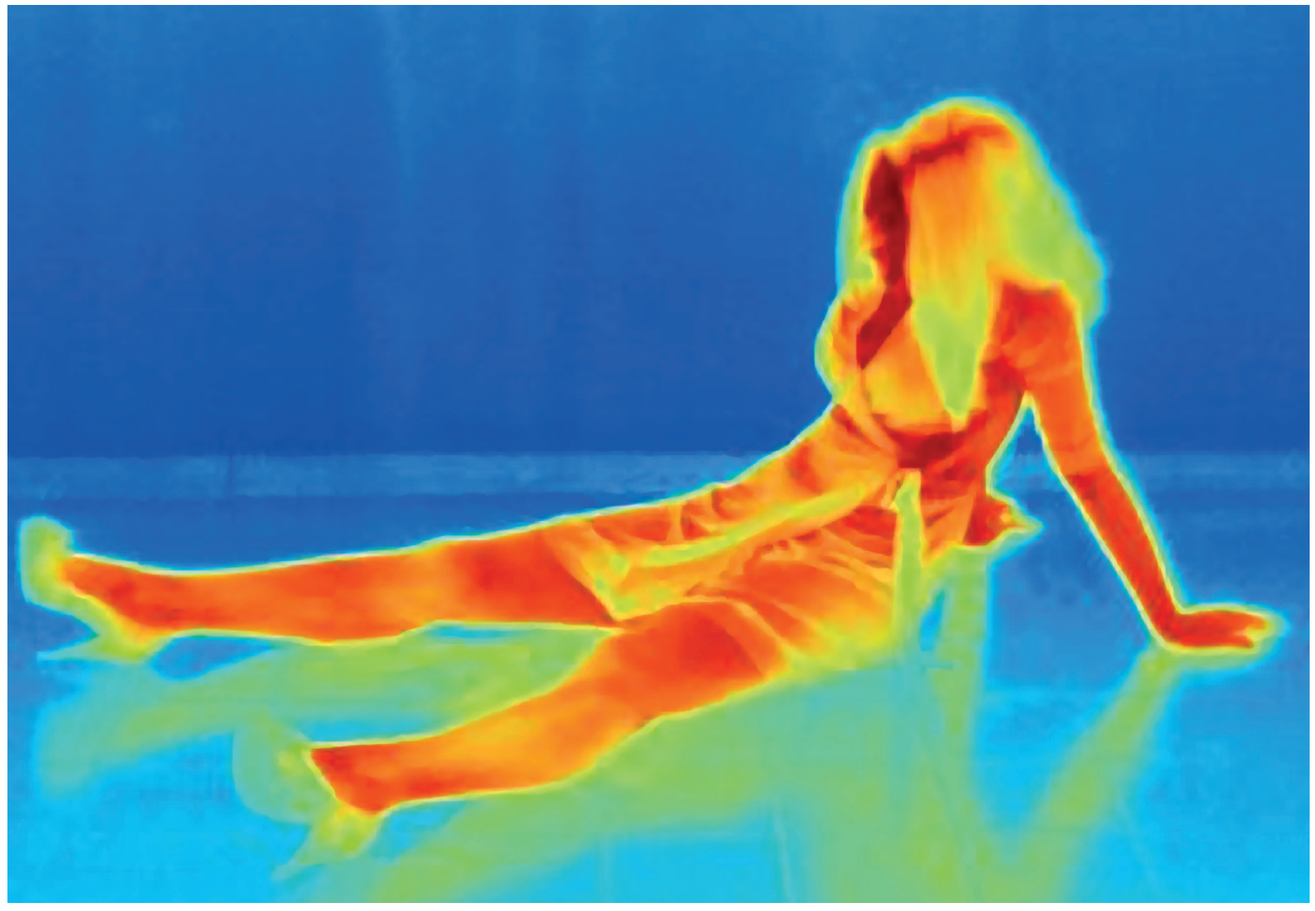
Thermal radiation occurs in the region of the electromagnetic spectrum from approximately 900 to 14,000 nanometres of wavelength, while phenomena such as gamma rays, X-rays, ultraviolet light, visible light and radio waves occur in the other regions. To capture these frequencies, each pixel in a thermal camera is a tiny electrical thermometer which measures the heat produced by the thermal radiation that hits it. Most thermal cameras incorporate a low-resolution optical sensor alongside the thermal sensor in order to permit simultaneous shots of the same object, which can be used individually, or combined as a "fusion" image.

The colour we see in a thermal image is constructed differently too. Because thermal cameras measure temperature, which is not part of the visible light spectrum, what's called a "pseudo-colour" is required. Perhaps the most psychologically intuitive pseudo-colour scheme is based on the use of red-orange colour for the hottest temperature, and dark blue for the coolest. Unless specifically blocked by the photographer using the camera settings, a thermal camera automatically applies this pseudo-colour in real time.

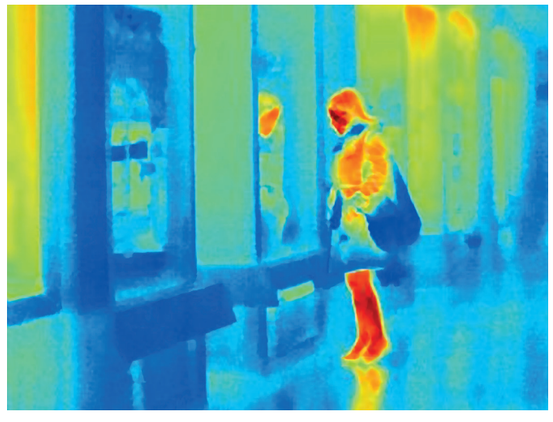
There is a lot of science involved in the capture of these images, and a lot of expense (a thermal camera can cost up to £40,000), but the results, I believe, can compare in an artistic sense to much of the photography we are more used to seeing. Like the X-rays of Nick Veasey or the scientific images collected by Jon Darius in *Beyond Vision* (1984), thermal photographs can also widen our understanding of the world. Susan Sontag famously stated that 'in teaching us a new visual code, photographs alter and enlarge our notion of what is worth looking at'. Evidence of this trend is the recent creative use of thermal photography in areas as varied as music videos and F1 racing.

Thermal images emphasise surface and texture. There is something physical about them. Form and gesture pop out of the page more strongly than with colour photographs, in a similar way to black and white photography. There are also parallels with some of the great works of night photography by names such as Georges Brassai and Volkmar Wentzel. Unlike the capturing of moon glow or the light of dawn, these individuals seemed repeatedly drawn to the aura of man-made sources and scenes – scenes that would probably have achieved a similar aesthetic and emotional impact if they had been shot using a thermal camera.

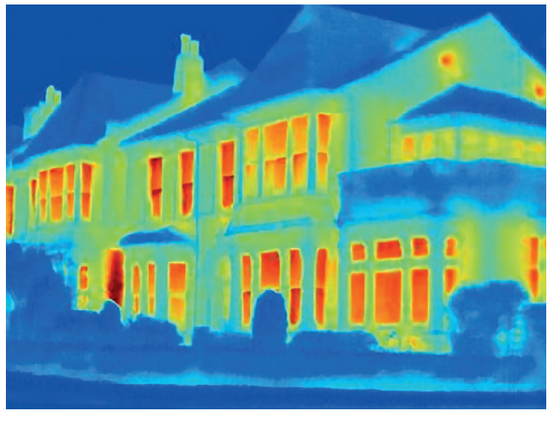
As creatures of curiosity people always try to see more of their world, and the many, varied and wonderful forms of optical photography have facilitated uncountable discoveries and emotions. The attraction of thermal photography, which is still in its infancy, will almost certainly prove just as compelling. Seeing heat is another curiosity which people will probably not be able to resist.



In Danae, 'form and gesture pop out of the page'



Window Shopping shows how thermal radiation can be reflected, like sunlight, off a shiny surface

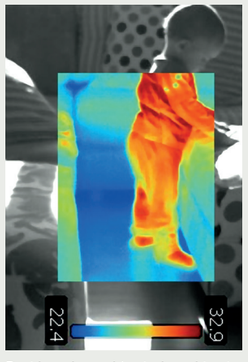


In this image, Winter's Day, a thermal camera captures temperature rather than colour, providing a glimpse into the wall to discover some of its internal structure

Today's commercial thermal cameras have a low-pixel resolution, resulting in 'impressionistic' images such as this one, Houses of Parliament

THERMAL IMAGING: QUICK QUESTIONS

What is thermal imaging? The capturing of the thermal radiation emitted from objects in proportion to their temperature.
Who uses it? Professionals including firefighters, to see through smoke; engineers, to measure heat loss; the military and police, for night vision, and medics for diagnostic screening.
How does it work? A thermal camera's sensor acts like a thermometer to measure temperature, translating it into an image we can understand visually.



Davide: a thermal/optical combination