Hiding one surface inside another

Description

Whatâ??s it like to get inside a surface? Iâ??ve been reading Avron Strollâ??s seminal philosophy book *Surfaces*. He exhausts most of the ways people use the word â??surfaceâ?• in everyday speech. E.g. you can be on a surface or under it, but itâ??s not usual to speak of a surface inside a surface. And some objects donâ??t have surfaces, e.g. shadows. He writes:

> â??One can draw an outline around a shadow, so that a shadow has a boundary; yet it would be odd to say that a shadow has a surface. No properties or features can be attributed to the surface of a shadow per se; it cannot be said to be dark or light, thick or thin, smooth or rough, wet or damp; nor can it be removed, sanded, polished, and so forthâ?• (32).

But most people enjoy searching for the exception to such rules. If we canâ??t find it in everyday language, then itâ??s there in architectural theory, metaphor, jokes, fantasy and literature, e.g. Peter Pan loses his shadow which Wendy then kindly sews back onto his body.

At least in his *Surfaces* book, Stroll doesnâ??t mention disguise, camouflage, dissimulation or other interesting breaks from the norms of â??surface talk.â?• He explains how surfaces can hide the contents of the objects they surround, as skin hides the view of internal organs, but not how one surface might hide another.

Dissimulated surfaces

Strollâ??s analysis mainly focusses on the perception of surfaces, and avoids patterns and images planted onto or etched into surfaces and how these become the surface. After all, fresco artists draw scenes that have surfaces onto surfaces. That surfaces become the bearers of images opens them up to an even richer vocabulary of experience.

Anamorphosis is the application of a distorted image onto a surface such that it is visible only from a particular angle of view, or with a lens or reflecting device, such as a polished cylinder placed over a key location in the picture. Architects are used to the idea that a room extends beyond the constraints of the roomâ??s wall surfaces, by painting, lighting, mouldings and reliefs that deliver an exaggerated or false perspective. Designed to be photographed from a particular vantage point, 3D pavement art breaks the bounds of surface.

Search Google image for â??camouflage architectureâ?• for examples of forms and surfaces that conceal, obscure, obfuscate and make ambiguous the shape and materials of buildings. Dazzle camouflage works particularly well on naval vessels and has developed into an art form. I saw this on the River Thames in 2015.

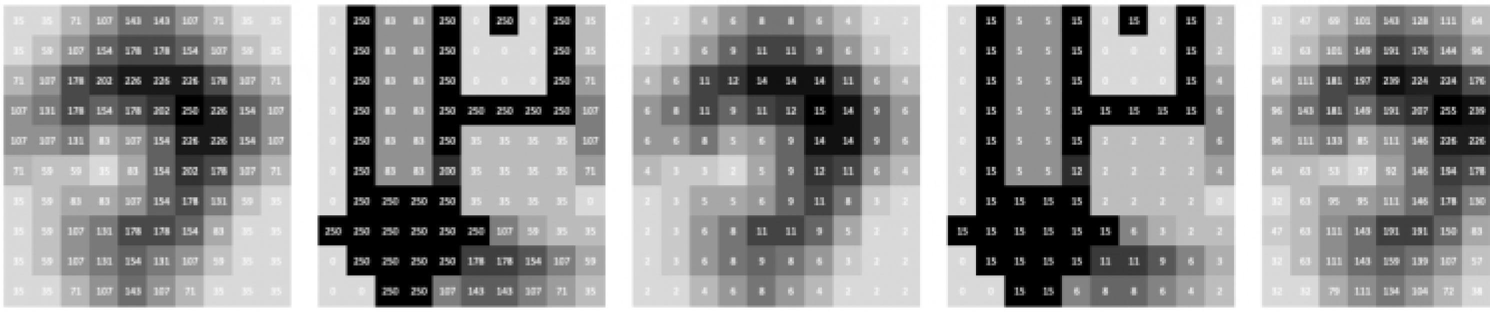
Surfaces made up of digitally-controlled arrays of mechanical components, electro-sensitive materials, colours and light sources, as well as surfaces onto which digital images are projected, compound surface phenomena and render surfaces dynamic, responsive and interactive.

Bit shifting

Iâ??m fixated on cryptographic surfaces at the moment. Steganography presents as a fascinating subspecies of dissimulated surfaces. I explained in a previous post how the colour value of a pixel is stored in a file as a number, usually in binary. In 8 bit colour, the grey colour 235 is 11101011. Removing the last 4 bits gives you 1110, which is 14. That process is called a â??bit shiftâ?• and itâ??s a very efficient (fast) operation in a binary computer. Itâ??s an easy way of reducing the pixel values in a grey scale image from 8 bit to 4 bit. 8 bit colour has a range of 0-255 values. 4 bit colour has values in the range of 0-15 colours. If you want to conceal the value of a pixel that exists in a second picture (e.g. 210 = 11010010) then you also bit shift that bit string by 4 to produce 1101 (13) and append these two bit strings. The pixel value of the hidden picture will make up the right half of the bit string. The new bit string will be 11101101 (237). In what follows, Iâ??ll just show decimal rather than binary values as they are easier to read. Helpfully, Excel has a function that performs bit shifts on decimal numbers. You donâ??t need to see the binary numbers at all, though I showed the process in a previous post.

The image on the left is a fragment of a grey-scale carrier image â?? perhaps an ear zoomed in close. The image to the right of that is a simplified and stylised plan of the Helsinki main station. Both images are then reduced from 8 bit colour to 4 bit and combined using the bit shift method described above. The difference is scarcely noticeable here, but at scale you would notice that the 8 bit grey scale image is of higher quality than the 4 bit version.

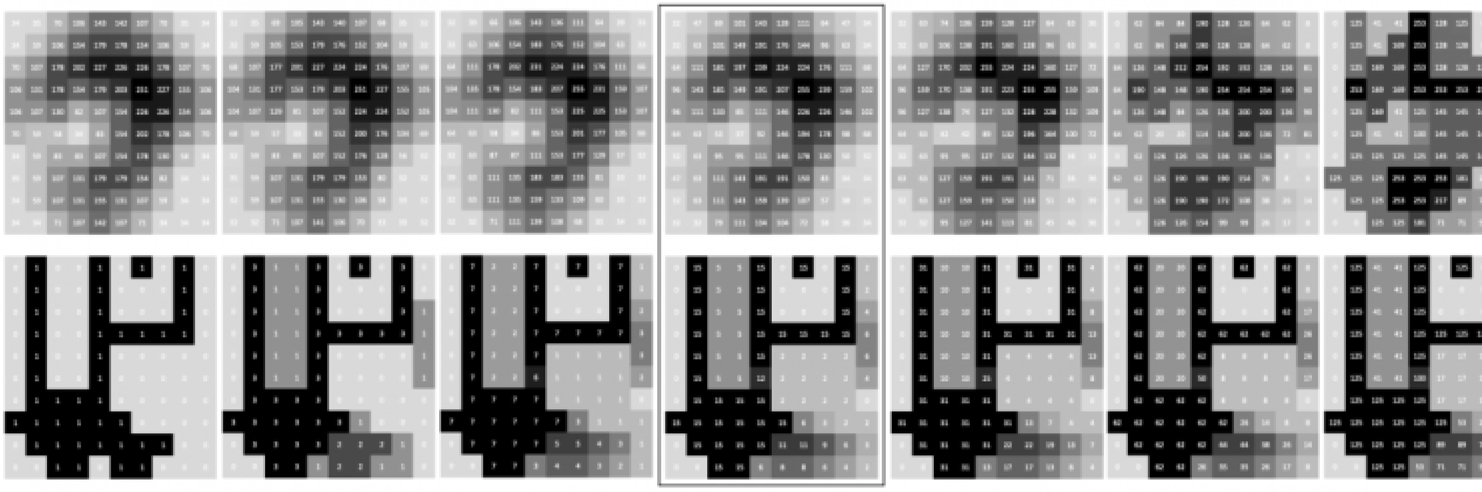
Thatâ??s the combined picture on the right. The station plan is invisibly concealed within the pixel values of the carrier picture. The combined picture is still 8 bit, and the hidden picture constitutes a subtle layer of random noise.



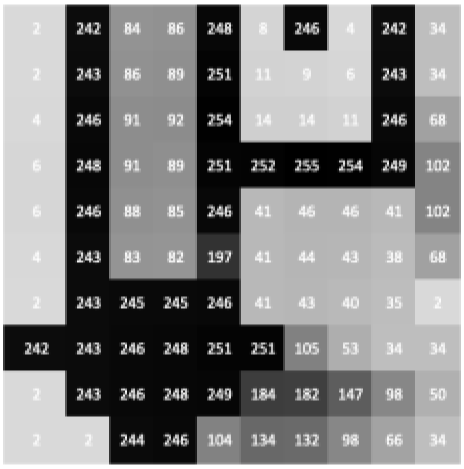
8 bit Carrier | 8 bit Hidden | 4 bit carrier | 4 bit hidden | 4 bit carrier + 4 bit hidde

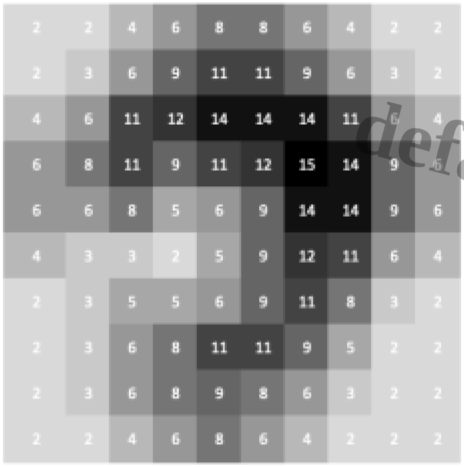
Recovery

The reverse bit-shift operation returns the hidden picture as shown below. I wanted to see what happens if the hidden picture is integrated into the carrier at different degrees of colour depth, i.e. 1, 2, 3, 4, 5, 6, 7 bits with a corresponding reduction in the colour depth of the carrier picture. Iâ??ve arranged these here. The central image shows both the carrier and the hidden picture at 4 bits colour. If the carrier picture is much less than 4 bits then the hidden image starts to show through when the images are combined, scrambling the combined picture, as evident at the far right.



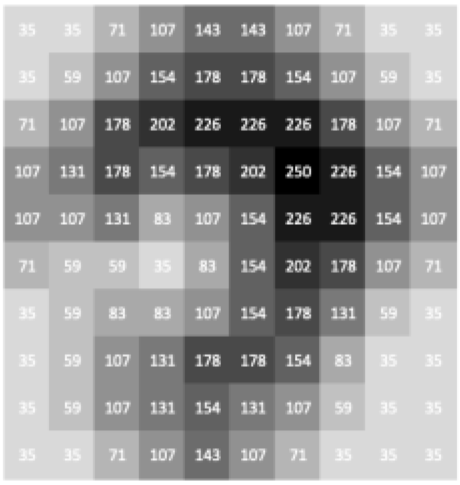
Here are a couple of images to prove that I can also hide the carrier picture inside the hidden picture, and recover it using the same method. Any picture can be hidden inside any other it seems.



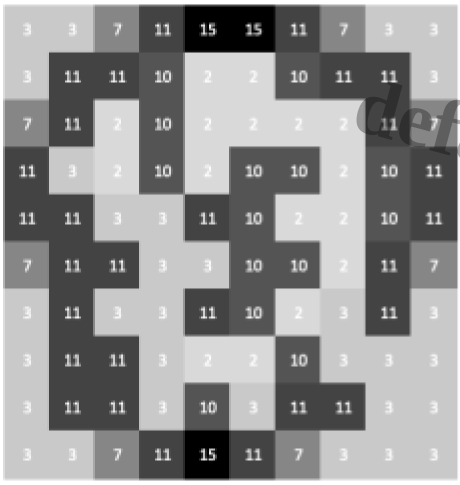


This demonstration shows that itâ??s possible to conceal hidden pictures in publicly visible display screens. Iâ??ve explored why anyone would do that in a previous post. Here, it allows one image to blend into another and remain undetected, but also to recover itself, like a chameleon.

Iâ??ve yet to see if a bit shift technique has been used to discover traces of objects or artefacts imprinted on land or urban surfaces. The recover process applied to a picture without hidden content would simply return an array of pixel values presenting the remainder after dividing by 16. Thatâ??s arbitrary in the case of a photograph of a surface. Hereâ??s what happens when I apply the recovery procedure to the original carrier picture that has no hidden picture.



8 bit Carrier



Looking for something that isn't there

It seems to highlight outlines and fits within a range of algorithms for detecting boundaries, exaggerating differences between coloured patches and identifying objects.

Bibliography

- Dorrian, Mark. 2013. On Google Earth. In Mark Dorrian, and FrÃ©dÃ©ric Pousin (eds.), *Seeing from Above: The Aerial View in Visual Culture*: 290-307. London: IB Tauris.
- Johnson, Neil F., and Suchil Jajodia. 1998. Exploring steganography: Seeing the unseen. *Computer (IEEE)*, (31) 2, 26-34.
- Stroll, Avron. 1988. *Surfaces*. Minneapolis, MN: University of Minnesota Press
- Leach, Neil. 2006. *Camouflage*. Cambridge, MA: MIT Press

Category

1. Architecture

Tags

1. bit shift

2. steganography

Date Created
July 18, 2020
Author
rcoyne99