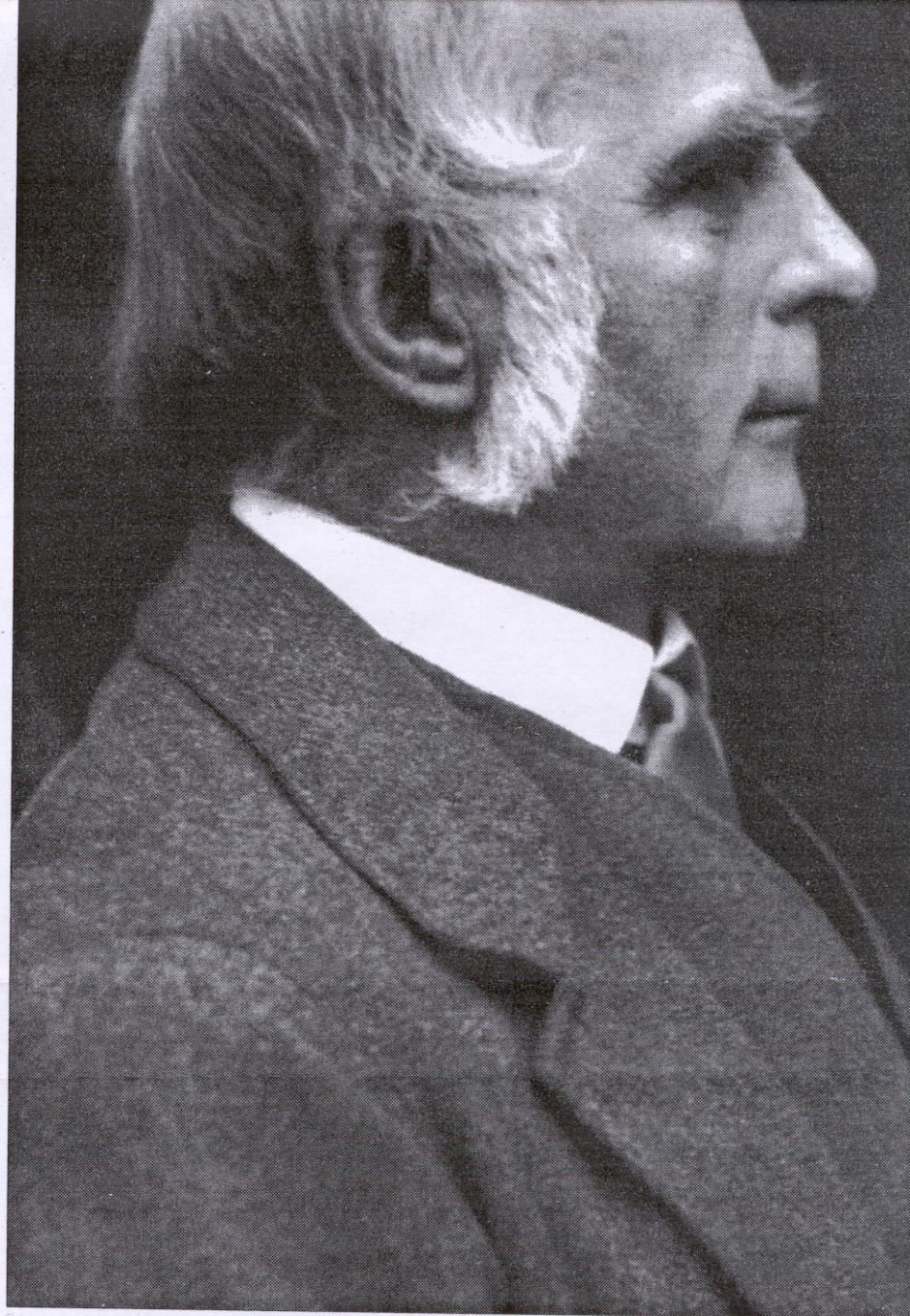




Bearable likeness of being

Never forget a face? You must be good with figures, says **Michael Morgan**



In 1929 a 15-tone picture of Generals Foch and Pershing — joint victors in the first world war — shaking hands was sent across the Atlantic Telegraph Cable. The process was slow by modern standards, because of the enormous amount of information involved. If the picture were divided into 512 by 512 small squares and within each square the brightness level signalled by one letter of Morse code, that would give a very modest resolution. However, at one letter per second, the information would take about three days to transmit. Engineers searched for and found ways to “compress” the images to send them more rapidly.

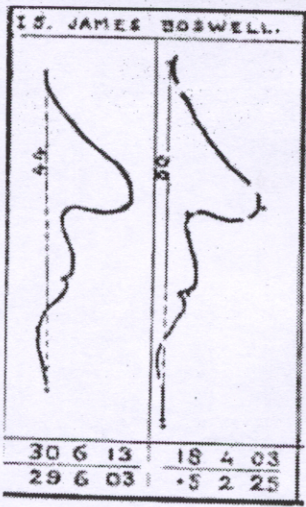
Their problem had been anticipated by Francis Galton, a man obsessed with human variability (behaviour included) and with accurate measurement. “The replacement in all scientific work by numerical values, in the place of vague adjectives, is a gain of first-class importance,” he said. His discovery of the unique nature of fingerprints was just one shot in his life-long war on the criminal classes. If pictures could be telegraphed, he said, “a refugee criminal could easily be outstripped by his portrait,

sufficiently like to him to justify, in connection with corroborating evidence, his being placed for a while under police observation”.

Galton used the society profiles of his time to produce a library of images. Each was reduced to “five cardinal points”: the notch between the brow and the nose, the tip of the nose, the notch between the nose and the upper lip, the parting of the lips and the tip of the chin. These distances were measured and by a clever coding scheme reduced to just four telegraphic words. As a result, the cost of transmission was just two pence.

Galton was to be disappointed. It took time and patience to make and decode the measurements. So an automatic method of compressing the information was called for.

Galton laid the foundations for that with his “average face”. He exposed negatives of many different faces onto a single print, to make a composite. He claimed that, for society ladies, the results were particularly beautiful, although “insipid” seems a more accurate description. Each individual face could now be described by a rather small set of numbers that expressed



Galton exposed the negatives of many faces onto a single print

its difference from the average. We do this already when describing someone as having a “long nose and long hair”. The question is how to automate this.

The answer lies in what mathematicians call “basis functions”. Instead of starting with the average of all faces, we take pictures of 26 individuals named A through Z; a “basis set”. The next step is to reproduce a new individual by mixing together the photographs in that set to make a match, just as all colours of the spectrum can be produced by mixing together the primary colours.

The individual could then be coded by a mere 26 numbers. One person might have a strong resemblance to A and thus be composed 85% of photograph A. But what if most members of the basis set look alike — as, after all, most people do? The answer is to make an artificial basis set in which ‘faces’ resemble one another as little as possible.

Generals Foch and Pershing, top left. Sir Francis Galton, above, whose measurements, left, laid the foundations for the facial fingerprint

MAIN PHOTOGRAPH: CORBIS

The “Eigenfaces” used look a bit odd, but can be guaranteed to do the job. Each individual can be described by 15 numbers, a recipe for mixing together the 16 Eigenfaces in the correct proportions. Later this year, you will be able to buy a PC that uses this technology to recognise you when you switch on (and will, unlike the famously stern Mr Galton) tell you to have a nice day. Galton hoped his profile system would express “Peculiarities of profile... in a way that promises to be serviceable for eugenic records.” What next for image processing?

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