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Facial Enigma

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Identifying other people from their facial appearance is almost primordial. The ability to recognise faces has been demonstrated in other primates, and the relevant cognitive and neurological structures may be shared. This makes sense in evolutionary terms. Faces convey biometric information that has considerable adaptive value, of which age and sex are perhaps the most obvious. Facial expression conveys information relating to behavioural intent, in aggression and submission, for example. The ability of the face to convey biological kin relationships is also significant given the strong in-group (preferences observed in the behaviour of most primate species. In highly social species like higher primates, the ability to recognise individuals from their faces is of additional importance in relation to male and female dominance hierarchies. In species where inter-group rivalry can be lethal, being able to recognise members of one's own group as distinct from unknown 'outsiders' may have conferred a particularly important evolutionary benefit.

All of this is consistent with the findings of psychologists interested in the study of face perception, who have shown convincingly that we are very good at recognising familiar faces, but very poor at recognising unfamiliar ones. We tend to be particularly poor at so-called 'cross-race' face recognition, and this is probably a simple consequence of our abilities being optimised for recognition of familiar face types. Familiarity will mitigate against this.

Given our lack of capability to recognise unfamiliar faces, it is probably no coincidence that the criminal justice system is littered with miscarriages of justice relating to mistaken eyewitness identification. These underpinned the establishment of the Court of Criminal Appeal—see the Adolph Beck case—and the requirement that the judge should caution the jury in eyewitness identification cases, culminating in the Turnbull Guidelines—see the Devlin Committee Report. While most of these errors relate to 'unfamiliar' face recognition, in some cases mistakes were made despite a degree of familiarity with the offender. In the Adolph Beck case, for instance, the victims had been on somewhat intimate terms with the man who had swindled them—a certain Wilhelm Meyer, who bore only a passing resemblance to Beck. There is a unique danger with familiar face recognition that mistakes can occasionally be made and our justifiable confidence in our general ability leaves us impervious to the possibility that we have made a mistake.

The ability to recognise familiar faces may explain the talents of investigative 'super-recognisers'—a term associated with members of the Metropolitan Police and colleagues who showed a particular propensity to be able to recognise offenders from CCTV images, notably following the London Riots of 2011. A substantial number of suspects they recognised were repeat offenders, however, and—in cases where the staff concerned were responsible for prisoners in custody, for example—this was to a large extent recognition of familiar faces. Further work with super-recognisers has now demonstrated that some are far more talented than most at recognising unfamiliar faces too.

This is a very useful resource in investigation, but it must be remembered that eyewitness identification is not one hundred percent reliable. Other corroborative evidence must be secured, with the caution that confessions too have been shown with hindsight to underlie miscarriages of justice. If accepted in court, evidence of recognition amounts to proof of identity. It therefore carries with it the burden of being as compelling as it may be prejudicial.

If humans are so good at recognising faces and possess a remarkable capability whose origins are lost in evolutionary time, why is it that a forensic science of facial identification has not so readily arisen? Why is there no fingerprinting or DNA profiling equivalent for faces or facial images?

Attempts to identify individuals using empirical methods in forensic investigation go back at least as far as the commendable efforts of Alphonse Bertillon (1853-1914), who developed a comprehensive system for anthropometric identification based on individual measurements of the body. Almost forgotten now, *Bertillonage* was used to classify millions of arrestees and offenders throughout the western world in the late nineteenth century until it was superceded by dermatoglyphic fingerprinting—a method found to be far quicker, cheaper, less error prone and more able to distinguish between individuals. One of Bertillon's legacies was the arrest photograph still commonly taken in anterior and lateral profiles at a $1/7^{th}$ scale.

Also forgotten is the attention Bertillon gave to the problem of facial identification. In addition to the anthropometric—measurement based—system, he developed a method for the classification of facial features including the general shape of the head and each of the individual features, the iris colour (for which he produced tinted charts to facilitate consistent assignment), and the location and description of facial marks (Figure 1). Bertillon was also aware of the key problem in facial identification: distinguishing between individuals who closely resemble each other. Distinguishing between dissimilar faces is easy: 'look-alikes' are the problem (Figure 2).

Bertillon did not pay so much attention to the measurement of faces, but this was an obsession with the anthropologists of the era, who collected millions of craniometric measurements. These studies could easily have been adapted to provide a statistically based means of comparing to faces or facial images by measurement and estimating the frequency of a set of measurements in the general population in an approach not dissimilar to that used today in DNA profiling.

Unfortunately, however, craniometry was used to support theories of 'racial' superiority and inferiority that were widely accepted in the early twentieth century, and which were only abandoned as a consequence of the terrible harms arising from Nazi racial ideology. Craniofacial anthropometry itself became unpopular, and following the discovery of blood group and DNA polymorphisms that offered more exact means of measuring genetic variation in populations it attracted little renewed scientific interest.

In the absence of a science of forensic facial comparison, a number of technical procedures have been used. These include photogrammetry or 'facial mapping', image superimpositions or 'wipes' and anthroscopic or morphological comparison. None of these methods have been subject to rigorous scientific attempts at falsification and the on-going publication of error rates. Only the anthroscopic method is based on traditional anatomy based classification methods that at least offer a means of thorough empirical comparison. None of them are supported by a statistic amounting to a 'random match probability' that would state how many other individuals in the population would also match.

In our own research, we attempted to study face shape variation by measurement of 30 craniofacial landmarks (Figure 3) and found that in a sample of over 3000 subjects as few as 8 landmarks were sufficient to distinguish any individual face in the dataset. If this particular set of 8 landmarks was not used, the discriminating power deteriorated. We also found that our dataset corresponded to a multivariate normal model—in other words, there were lots of similar face geometries near to the average. This meant that common faces were particularly different to tell apart. Finally, although our

findings suggested measurement could be used under good conditions, the quality of CCTV images of offenders we received were very poor and rarely amenable to similarly accurate measurement.

In our current research, we are attempting to complement the anthropometric approach with the location and classification of facial marks or 'minutiae'. For illustration, it can be demonstrated that monozygotic 'identical' twins can be distinguished in this way (Figure 4).

At present, neither anthropometric or anthroscopic methods are practical for routine use, but this impediment is chiefly due to the quality of CCTV or other images of offenders. The resolution of commercial cameras is such that images of adequate quality can be collected from suspects, but that offender image quality tends to be inadequate for empirical scientific comparison.

In time, the now rudimentary imaging technology used in most existing CCTV surveillance equipment will be superseded and offender image quality will converge with anthropometric and anthroscopic research to deliver methods that will permit a science of forensic facial comparison for the courts. But, given that videotape based analogue systems are still in use and that unmonitored and even unconnected CCTV cameras appear to have an effect, if not of deterrence then of assuaging public concern, then this point of convergence may be a long way off. Opinion evidence may be the only option for the time being.

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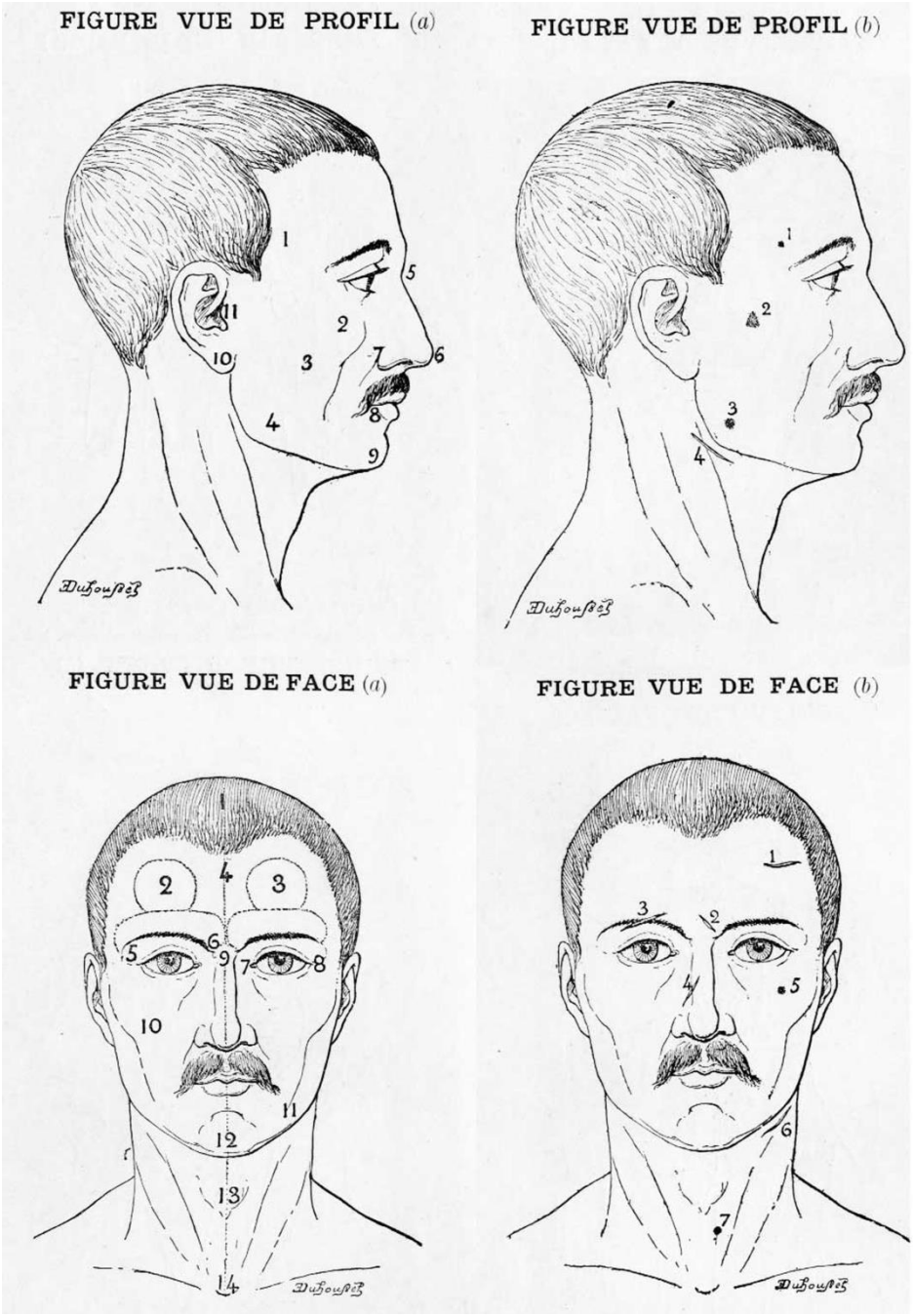

Figure 1. Images used by Bertillon (1885) to support his classification of facial marks or 'minutiae' in human identification.

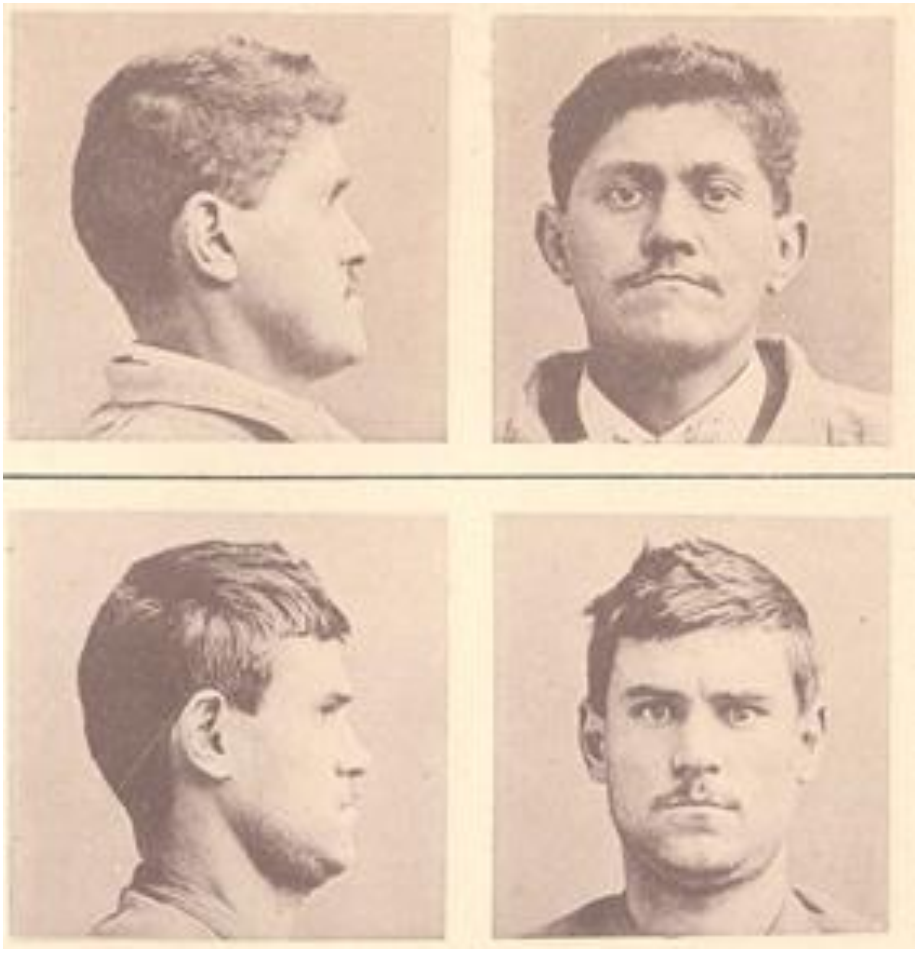

Figure 2. Example of ‘look-alikes’ from Bertillon (1885).

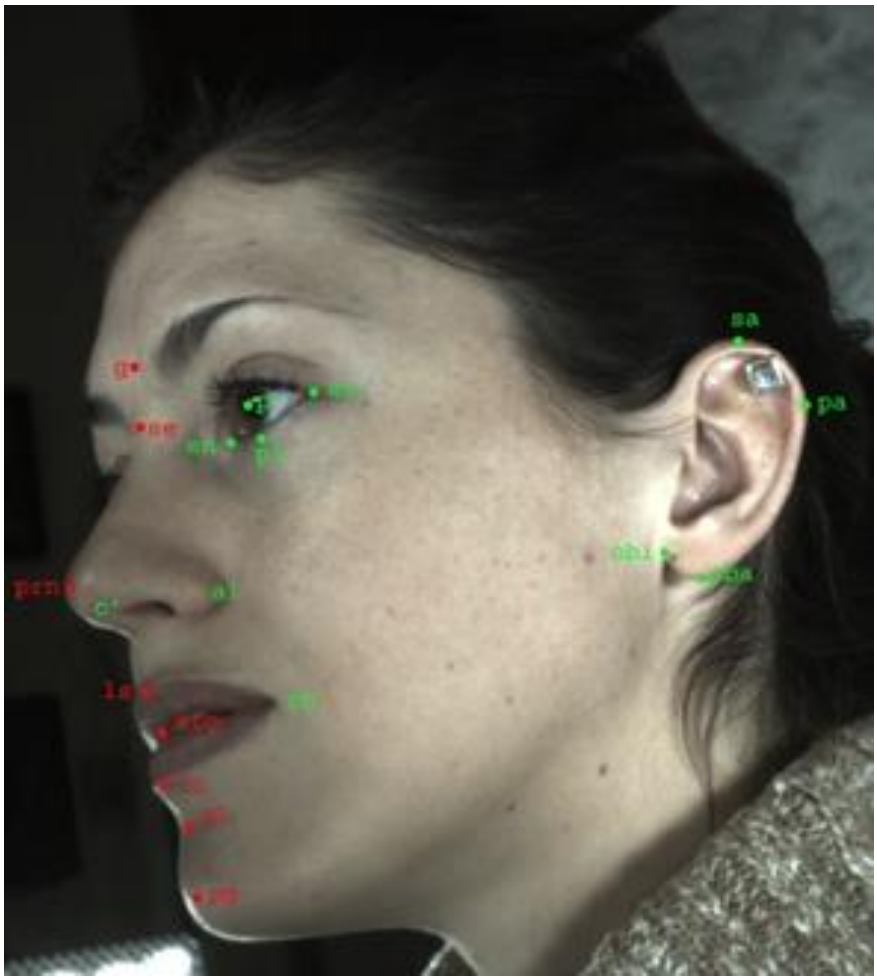

Figure 3. Location of the 30 craniofacial landmarks used to measure each subject in a sample of over 3000 faces. As few as 8 landmarks were sufficient to achieve identification of any given individual in the dataset (Evison and Vorder Bruegge 2010).

Figure 4. The Whitehead twins charged with their mother's murder. The twins can be distinguished by facial minutiae even in these images.