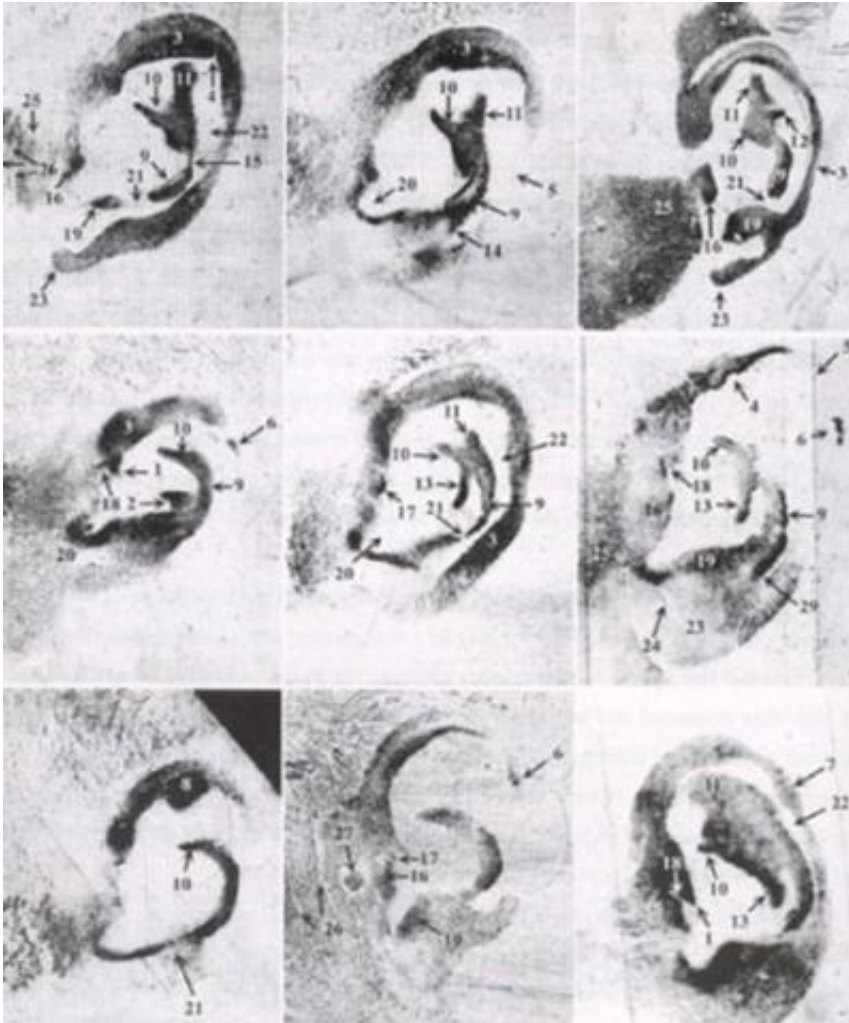# Earprints as evidence?

February 24 2006

Burglars often listen at windows and doors, leaving an earprint behind, which, just like a finger print, can be used to trace them. Lynn

Meijerman is researching the value of ear prints as evidence in identifying criminals.

In one out of every twenty burglaries the burglar leaves an earprint behind, at least this seems to be the case in and around Leiden. Fingerprints have long been accepted as evidence, but what about earprints?

Do the earprints of an individual differ enough from the earprints of all other individuals in the world to identify a criminal with complete certainty? Meijerman: 'No, you can't be a hundred per cent sure, but fingerprints aren't that certain either. We assume that no two fingerprints are the same, but we don't know for certain.'

Earprints of different people; the numbers indicate the places where the most characteristic differences can be seen.

But no two fingerprints have ever been found which are identical? Meijerman: 'No, but a lot of misidentifications have been made on the basis of fingerprints. The problem is that even prints of the same finger are never exactly identical. The way the print is made, for example, how firmly the finger is pressed on the paper, or the way the finger is rotated, may differ slightly. It all comes down to how the print is interpreted. Are the differences minor enough to be able to assume that they are from the same finger or the same ear?

Ideally, there should be a comprehensive statistical process to back this up which allows you to calculate the likelihood of finding this degree of similarity, assuming that two prints come from the same ear or finger, weighed against the chance that you could find this degree of similarity if the prints came from different ears or finger. This is called the likelihood ratio. With the FearlD research project we have tried to contribute to the answer to this question as far as earprints are

concerned. Such research has never been done with fingerprints as far as I am aware.'

Meijerman works for FearID: the Forensic Ear Identification project which was running from February 2002 to May 2005 and which was financed by the European Union. FearID partners are currently working on software which will make it possible to express statistically how great the likelihood is that a particular earprint comes from a particular suspect. This figure will never be 100%. How high it is depends very much on the ear in question. Meijerman: 'An ear that has a lot of individual characteristcs is very useful as evidence. An ear which has very few identifying characteristics is much harder to ascribe to one particular person. It's not for nothing that I put forward my proposition: 'The morphology of an ear in part determines the suitability of the owner of the ear for the profession of burglar.' Thieves with average ears, therefore, have an advantage because their earprints are much more difficult to attribute to one particular individual.

Terms used to describe the characteristics of an ear.

But the quality of the earprint also affects the level of the score. You can have a match - this ear is most like that ear - but if the match is based on an earprint which shows very few characteristics, for example a small piece of the pinna, then the match has less value. If, on the other hand, you have a clear print of the whole ear, showing every fold, wrinkle, spot and mole, then the likelihood ratio will be much greater. And if the shape of the ear is reasonably unique, then it really starts to be interesting.

Meijerman: 'If you can express the value of the match in the form of a number, then you have an objective standard on which a judge could base his decision. With fingerprints this is never asked. If an expert says it is a match, then it's a match. And no judge says: "How can you be sure

of that?" or "What is the likelihood that it isn't a match?" There are many examples across the world of cases of misinterprtations, people who have been convicted on the basis of a fingerprint, which on further inspection turned out not to belong to this particular suspect...'

So, there are big differences between earprints of different ears, but also between prints of the same ear. In her doctoral disseration, Meijerman particularly concentrated on this last issue. "It makes a lot of difference how strongly the person presses his ear against the surface. Even the surface against which the ear is pressed, the door or example through which he is trying to listen can make a difference to the final earprint. More pressure, or listening for longer, not only gives a bigger print surface per part of the ear, it can also cause a slight change in the relative position of the different anatomical parts of the ear. You have to take this into account when developing software for classification or for matching.'

Are the police currently using earprints? Do the technical investigators make it standard procedure to treat the windows and doors with aluminium powder to try to find earprints? And if so, are the earprints they find stored in a databank? Meijerman: 'Not really, it depends entirely on the regional police force in question. In Leiden, for example, which falls under Hollands Midden, the police are quite active in searching for evidence after break-ins, but in The Hague, which falls under a different region, they do much less. Apparently their priorities lie elsewhere.'

In order to see whether an earprint matches a known suspect, you have to be able to compare the prints in a database. FearID has developed a computer programme which allows you to do automatically. You enter an earprint in the computer and the programme selects those earprints which are most similar, with the most similar ones at the top, then those where the match is slightly less, and so on. The software is based on a

database with earprints of 1350 people, with three different prints for each person. Statistically, this number gives reasonably reliable results. But what you can't do at the moment is assign a value to the matches. This would be the next step in the research. But even without statistical values, the matches which are identified are still useful. We can use them to rule out suspects, so that the police don't wast time continuing investigating people unnecessarily. And if there are two different ears in a set of evidence, you can establish that the burglary was committed by two people. These are all very useful pieces of information for the police.'

Just how useful is identification on the basis of earprints?

Meijerman: 'That depends on what you want to compare. I can't compare it to fingerprints because I don't have any figures, but our results indicate that this is an extremely useful tool, with a lot of potential. In saying this, I'm not commenting on the qality of my own research, but I am commenting on the usefulness of the results which the FearlD project have achieved as a whole. And we're only just at the beginning. The most important aspect of this project is that we have made it possible to objectively evaluate something which had no scientific basis.'

Lynn Meijerman obtained her doctorate on 15th February, under the supervision of Professor George Maat.

Source: Universiteit Leiden