

EARS: THE NEW FINGERPRINTS?



ALL EARS ARE THE SAME, RIGHT? OR WRONG?

EARS ARE ACTUALLY UNIQUE TO EACH AND EVERY PERSON, SO MUCH SO THAT THEY ARE COMPARABLE IN UNIQUENESS TO THE FINGERPRINT. RESEARCH HAS EVEN SUGGESTED THAT EARS MAY BE A MORE EFFECTIVE IDENTIFICATION TOOL THAN A FINGERPRINT THROUGH THE USE OF A NEW "IMAGE RAY TRANSFORM" TECHNOLOGY. THIS TECHNOLOGY SHINES BEAMS OF LIGHT ON THE TUBULAR FEATURES OF THE OUTER EAR, CREATING AN IMAGE FROM THE WAY LIGHT REFLECTS OFF THE EAR'S CURVES. WHAT MAKES THE EAR SO UNIQUE? ONE'S EARS ARE FULLY FORMED AT BIRTH AND AGE GRACEFULLY OVER TIME, MAKING THEM AN IDEAL BODY PART TO CONFIRM IDENTITY. FINGERPRINTS CAN CHANGE DUE TO THE DEVELOPMENT OF CALLUSES FROM REPEATED LABOR WHICH CAN MAKE THEM LESS RELIABLE.

IN ALMOST EVERY CRIME SCENE TV DRAMA, YOU'RE LIKELY TO SEE CHARACTERS DUSTING FOR FINGERPRINTS. WHEN WILL WE SEE THEM DUSTING FOR EAR PRINTS? WELL, I GUESS IT'S A LOT LESS LIKELY THAT YOUR AVERAGE CRIMINAL IS PRESSING AN EAR AGAINST AN OBJECT WHILE COMMITTING A CRIME. YET IN 1998, THE FIRST MURDER CONVICTION ON THE BASIS OF EAR IDENTIFICATION OCCURRED IN ENGLAND. THE CONVICTED SUSPECT PRESSED HIS EAR UP AGAINST A NEWLY WASHED WINDOW IN THE HOUSE (WHERE THE MURDER TOOK PLACE) TO LISTEN FOR MOVEMENT.

AIRPORTS ALSO REGULARLY USE BIOMETRIC FACIAL RECOGNITION PROGRAMS IN THEIR SECURITY PROGRAMS. THE ADDITION OF EAR PRINTS TO THIS TYPE OF SECURITY COULD ALSO PROVE A VALUABLE WAY TO IDENTIFY TRAVELERS AS WELL AS ANY POTENTIAL THREATS.

EAR PRINTS COME WITH LIMITATIONS WHEN IT COMES TO IDENTIFICATION, HOWEVER. EARS CAN BE ALTERED IN SHAPE THROUGH PLASTIC SURGERY OR FROM AN ACCIDENT. WEARING EARRINGS OR EYEGASSES OR HAVING HAIR PUSHED BEHIND THE EAR CAN ALSO ALTER THE SHAPE OF AN EAR PRINT.

WHILE AN EAR PRINT WILL LIKELY WILL NOT SUBSTITUTE THE FINGERPRINT IN TERMS OF IDENTIFICATION CAPABILITY, IT COULD BE A VALUABLE ADDITION FOR SOLVING MYSTERIES, SAVING LIVES, AND LIKELY MANY OTHER USES.

EARS: THE NEW FINGERPRINTS?

THE TUBULAR AND UNIQUE CURVES OF THE OUTER EAR ARE ANALYZED USING THE IMAGE RAY TRANSFORM ALGORITHM. IMAGE COURTESY OF METHOD SHOP.

SPY MOVIES AND WEEKEND TELEVISION MARATHONS OF CSI HAVE ESTABLISHED THE POWERS OF FINGERPRINT ANALYSIS AND FACIAL AND IRIS RECOGNITION SOFTWARE TO IDENTIFY CRIMINAL SUSPECTS. THE EAR, HOWEVER, MAY PROVE TO BE AN EVEN MORE EFFECTIVE IDENTIFICATION TOOL THAN ANY OF THESE TECHNIQUES DUE TO A NEW TECHNOLOGY KNOWN AS THE "IMAGE RAY TRANSFORM." MARK NIXON, A COMPUTER SCIENTIST AT THE UNIVERSITY OF SOUTHAMPTON'S SCHOOL OF ELECTRONICS AND COMPUTER SCIENCE AND THE LEADER OF THIS TECHNOLOGY'S RESEARCH, RECENTLY PRESENTED THE NEW ALGORITHM AT THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS FOURTH INTERNATIONAL CONFERENCE ON BIOMETRICS.

THE IMAGE RAY TRANSFORM TECHNIQUE TAKES ADVANTAGE OF THE TUBULAR FEATURES OF THE OUTER EAR. RAYS OF LIGHT ARE SHINED ON THE EAR, AND THE SOFTWARE ANALYZES THE WAY LIGHT REFLECTS OFF ITS CURVED FEATURES AND CREATES AN IMAGE FROM THIS ANALYSIS. BY REPEATING THIS PROCESS THOUSANDS OF TIMES, A CLEAR IMAGE OF THE EAR IS FORMED. SUBSEQUENTLY, THESE CURVES ARE TRANSLATED INTO A SERIES OF NUMBERS THAT CAN BE USED AS AN IDENTIFICATION TOOL. ACCORDING TO ALASTAIR CUMMINGS, THE COMPUTER SCIENTIST AT UNIVERSITY OF SOUTHAMPTON WHO DEVELOPED THE PROGRAM, THIS METHOD OF EAR IDENTIFICATION BOASTS A 99.6 PERCENT SUCCESS RATE IN AN IDENTIFICATION TEST WITH OVER 250 IMAGES OF EARS. BECAUSE

EARS ARE NOT AFFECTED BY FACIAL EXPRESSION OR BY DIFFERENCES IN BACKGROUND, NIXON ALLEGES THAT IMAGE RAY TRANSFORM FOR EARS CAN BE USED AS A RELIABLE BIOMETRIC INDICATOR.

DESPITE THIS POTENTIALLY PROMISING OUTLOOK, THERE ARE A NUMBER OF LIMITATIONS FOR THE NOVEL TECHNOLOGY. FOR EXAMPLE, SOME EXPERTS QUESTION THE ABILITY OF EARS TO SERVE AS A PRACTICAL IDENTIFICATION TOOL BECAUSE OF THE POSSIBILITY OF EAR TRANSFORMATION WITH AGE. ALTHOUGH THE EAR IS FULLY FORMED AT BIRTH, WHETHER IT SIGNIFICANTLY CHANGES DUE TO AGING OVER TIME REMAINS A CONTROVERSIAL POINT. YALE PROFESSOR OF OTOLARYNGOLOGY, CELLULAR AND MOLECULAR PHYSIOLOGY, AND NEUROBIOLOGY JOSEPH SANTOS-SACCHI IS ALSO SKEPTICAL OF USING THE EAR AS A BIOMETRICAL INDICATOR.

"ADDITIONAL MEASURES BEYOND FINGERPRINTS AND FACIAL RECOGNITION FOR IDENTIFICATION ARE ALWAYS WELCOME, BUT PEOPLE MORE LIKELY WILL MANIPULATE THEIR EARS WITH JEWELRY AND SO ON, WHICH CAN ALTER THE SHAPE OF THE EAR. I DO NOT KNOW HOW EFFECTIVE IT WOULD BE USING THE EARS AS A SUBSTITUTE FOR FINGERPRINTS, THOUGH THE DETAILS OF THE OUTER EAR ARE UNIQUE TO PEOPLE," HE SAYS. SANTOS-SACCHI ALSO ADDS THAT EARS CAN BE EASILY CHANGED WITH PLASTIC SURGERY. OTHER LIMITATIONS THAT NEED TO BE ADDRESSED FOR IMAGE RAY TECHNOLOGY INCLUDE HAIR AND GLASSES FRAMES COVERING THE EARS, INSUFFICIENT LIGHTING CONDITIONS, AND VARYING ANGLES OF EAR IMAGES.

FURTHERMORE, SOME SCIENTISTS DOUBT THE NEED FOR THIS NEW TECHNOLOGY. ACCORDING TO DR. GISELLA CACCONE, DIRECTOR OF

THE DNA ANALYSIS FACILITY ON SCIENCE HILL AT YALE, THE USE OF EARS AS AN INDICATOR IS NOT COMPARABLE TO CURRENT TECHNOLOGIES OF BIOMETRIC IDENTIFICATION SUCH AS FINGERPRINTING. "USING THE EARS MAY BE FASTER AND CHEAPER, BUT I DO NOT KNOW IF IT WILL BE AS ACCURATE," CACCONE SAYS. FINGERPRINT ANALYSIS HAS BEEN THE MOST COMMON AND RELIABLE FORM OF BIOMETRIC ANALYSIS FOR THE PAST CENTURY AND HAS BEEN IMPLEMENTED IN MANY SECURITY PACKAGES. HOWEVER, FINGERPRINT BIOMETRIC ANALYSIS TECHNOLOGY, WHICH ANALYZES THE WHORLS, ARCHES, RIDGES, AND LOOPS OF FINGERPRINTS, HAS ALSO BEEN CALLED INTO QUESTION AND CRITICIZED DESPITE ITS INCREASED SOPHISTICATION IN RECENT YEARS. EXPERTS ARE CONCERNED THAT FINGERPRINTS CAN BE DESTROYED OR WORN AWAY, WHICH IS ACTUALLY COMMON IN CERTAIN WORK INDUSTRIES AND IN SOME TYPES OF ACCIDENTS. AND EVEN IRISES, WHICH ALSO HAVE BEEN TRADITIONALLY LAUDED AS RELIABLE BIOMETRIC INDICATORS, SHOW EVIDENCE OF REDUCED IDENTIFICATION ACCURACY DUE TO AGING.

SINCE ALL IDENTIFICATION TECHNIQUES THAT ARE DEPENDENT ON PHYSICAL CHARACTERISTICS POSSESS SIMILAR LIMITATIONS, THE ADVENT OF A PROMISING NEW BIOMETRIC TECHNOLOGY IS SEEN AS A TOOL TO SUPPLEMENT, NOT SUPPLANT, THE USE OF CURRENT TECHNOLOGIES. THE IMAGE RAY TRANSFORM ALGORITHM IS THEREFORE REGARDED SKEPTICALLY BUT WITH HOPEFUL INTEREST. THE USE OF EARS AS A BIOMETRIC IDENTIFICATION TOOL COULD POTENTIALLY BE VERY USEFUL IN SURVEILLANCE SITUATIONS WHEN SUSPECTS ARE TOO FAR FOR AN IRIS SCAN OR WHEN ONLY PROFILES OF SUSPECTS ARE ATTAINABLE, SUCH AS IN PASSPORT PHOTOS AND IN AIRPORT SECURITY ID CHECKS. ADDITIONALLY, ESTABLISHING A

DATABASE OF EAR IMAGES WOULD BE NON-INTRUSIVE TO INDIVIDUALS AND COST-EFFICIENT TO INDUSTRIES. NIXON'S RESEARCH GROUP AT THE UNIVERSITY OF SOUTHAMPTON HOPES TO IMPROVE THE ALGORITHM SO THAT IT CAN EVENTUALLY ANALYZE THREE-DIMENSIONAL IMAGES QUICKLY ENOUGH TO ALLOW THE PROGRAM TO TRANSLATE FROM A MERELY FASCINATING TECHNOLOGY WITH THEORETICAL SUCCESS TO ONE THAT IS APPLICABLE AND PRACTICAL IN REAL-LIFE SITUATIONS, SUCH AS EXTRACTING INFORMATION FROM BLURRY SECURITY CAMERA PHOTOS.