COMPUTER TOOLS USED IN FORENSIC DOCUMENT EXAMINATION

The following summaries of Computer Tools used in Forensic Document Examination are not exhaustive or all-inclusive of every detail, but were compiled from various sources to serve as an overview and general summary of note worthy computer tools that forensic document examiners should be familiar with.

For further information, any interested forensic document examiner is encouraged to perform additional research on these or any other computer programs used in forensic document examination and/or forensic sciences. Additions to the summaries listed here are always welcome.

FISH (Forensic Information System for Handwriting)

In the mid 1970's the German Federal Police (Bundeskriminalamt "BKA") had compiled an overwhelming amount of writing generated from terrorist communications and threats against public officials. Handwriting examiners were tasked to compare unknown subjects against large populations of writers. A computer project team consisting of document examiners, computer experts and mathematicians was established to harness computer power to solve this problem. Ten years and over ten million dollars later the Forensic Information System for Handwriting ("FISH") prototype was produced that allowed document examiners to enter hand generated material into the system and search it against previously entered records. Document experts then viewed a list of candidates and any similar writings were verified by traditional examinations and comparisons.

In the early 1980's, the Forensic Service Division of the U.S. Secret Service had learned of this new technology and its possible application to our protective mission. After careful study by FSD and the Information Resources Management Division (IRMD), it was decided that FISH could provide the Secret Service with a tool to search new, threatening correspondence against threats previously directed to the President, his

family and other protectees of the Service. A dialogue was established with the German Federal Police with a final agreement reached in 1989. This agreement stipulated that Forensic Science Division of the USSS would develop and test an English language version of FISH, provide the results to the Germans, and would not divulge any program source codes without permission of the BKA. The Secret Service would be established as the point of contact if other English-speaking law enforcement entities requested information about FISH. The German version was translated, modified to meet specific requirements, and became operational in 1991.

FISH allows forensic document analysts to scan, digitize and search questioned and known text writing against previously entered records. From the scanned images, a block of writing is extracted and treated by algorithms and compared to prototype writing. The differences between the questioned writing and the prototype writing are calculated and stored as a series of numbers in the database. Certain letters and/or letter combinations are isolated and line-raced, subjected to mathematical computations, and again, stored as numbers in the database. Finally, characteristics such as height, width, slant, lower extensions, upper extensions, base oval height, loop formations and distance between base lines are measured and stored. Then the questioned writing is searched, FISH actually compares the numbers that are generated from the algorithms, and ranks the writings previously entered. Writing from a document that differs from the prototype in the most similar manner, is ranked highest on the candidate list. Up to fourteen different searches are performed on each questioned document. Each list is then examined to determine whether the author of the questioned document is the author of any of the documents presented on the list. If similar writing is found, the original documents are submitted for a forensic document examination. FISH is a forensic tool that is instrumental in narrowing down a large population of writing into a manageable number for forensic document examinations.

FLASH ID

Described as "A Totally Automated, Language-Independent System for Handwriting Identification" FLASH ID™ is the government's name for their application of FLEX-Tracker™ handwriting biometrics software developed by Gannon Technologies in conjunction with George Mason University for use by the Federal bureau of Investigation. Using FLASH ID, Individual features of handwriting can be empirically captured into a "loss less" data structure that preserves the topology and geometry of the original writing. It is then possible to perform statistical analysis of this data structure to capture those elements that link the writing to its writer. The methods for taking known writing samples and capturing them as a data structure are based on Graph Theory replete with both topology and hundreds of detailed physical measurements. This data structure can then be analyzed using statistical methods to distill the topological and physical features into a "biometric kernel". The Biometric Kernel is the statistically derived subset of those measurements that truly captures the essence of an individual's writing. Otherwise stated, the Biometric Kernel consists of

those features that hold most consistent within an individual's writing and vary the most across multiple different writers. Once the Biometric Kernel is established, FLASH ID can act on unknown sample of handwriting and will return the nearest value in its handwriting reference database that provides the closest match to the questioned writing sample.

FLASH ID represents a new approach toward using handwriting as a biometric identifier that does not attempt to replicate the actions of a Forensic Document Examiner. Rather, it brings to bear the power of what computers do very well—rapid capture and processing of large quantities of data—into the hands of forensic experts.

FLASH ID represents a totally automated process for extracting graphical data from handwritten documents, analyzing this data using established statistical methods and matching documents based on similarity of the captured writing. The technology underlying FLASH ID is language independent. That is, the empirical and analytical techniques that power the handwriting derived biometric process have been demonstrated to function in different languages with completely different scripts.

In the form of FLASH ID, the Federal Bureau of Investigation now has a tool that harnesses the power of automation to leverage the effectiveness of Document Examiners by capturing similarities embedded among multiple writing samples and graphically showcasing these similarities supported by the statistical analysis that led to their identification. FLASH ID will also extend document forensics across language barriers—something that has not been practiced previously.

CEDAR-FOX

With the U. S. Supreme Court's ruling in the Daubert case in 1993, guidelines were established for the admissibility of scientific evidence. As a result, research became necessary in the area of handwriting examination and comparison to validate the hypothesis that handwriting is individual.

Dr. Sager Srihari, a computer scientist and director of the Center of Excellence in Document Analysis and Recognition (CEDAR) at the State University of New York in Buffalo had already begun such research as early as the 1980s, and had assisted the U.S Postal Service in the development of software that would recognize handwritten address on envelopes and convert them to bar codes.

Dr. Srihari further refined the software (known as CEDAR-FOX) to extract and measure handwriting features to determine whether two documents were produced by the same or different writers. The software enabled analysis of a total of 11 features that characterize the structure of the writing called ("macro features"), such as size, margins, spacing, pressure and slant, as well as 512 features of individual letters and numbers (called "micro features"). In a study involving over 1500 individuals from five states in

the U.S., CEDAR-FOX software was able to correctly determine whether two writings were by the same or different writers with a 95% accuracy rate. The results of this study were published in July 2002 in the Journal of Forensic Science.

Write-On 2.0 Software

Write-On software, marketed through Pikaso Software, Inc., was developed to collect, dissect, search, and manage large quantities of documents of all kinds. Originally designed to assist forensic document examiners (FDE) in analyzing handwriting, the newer version of Write-On can assist all types of professionals involved in collecting and cataloguing many varieties of documents.

Forensic document examiners may use it to review, dissect, and assess natural variations in handwriting, and report their findings. Write-On has not been designed to replace the expert witness. It has been developed to be used as a tool to collect, search, analyze, and report data.

Each document is entered in the system by importing or scanning its image. The document, authors, or the exact transcript of the document (or parts thereof) are then entered and associated to the document in question. Once in the system, complete or partial documents may be searched and presented in various forms. Write-On automatically creates a word index, occurrence charts, and document maps. Portions of documents can be extracted and exported into various reports.

Write-On 2.0 allows users to dictate how they will collect and search through data. The integrated search and reporting features allow FDEs to create and save multiple reports that can be easily accessed and printed.