A Convincing "Big Picture" of Facts

DVI-Teams Recommended

Three Phases:

CHAPTER 2. DENTAL DVI

2.1. Forensic Odontology

The definition and history could be touched briefly here as an introduction to this noble art and science. Forensic odontology is a part of criminalistics (forensic science if you like). Keiser-Nielsen (1967) defines it as "the proper handling and examination for the dental evidence, in the interests of Justice, so that the dental findings may be properly presented and evaluated".

We can follow the history of dental identification and forensic odontology as well as the whole forensic medicine to ancient Rome. But the application in DVI-work is only about 100 years old innovation. The fire of the Ringtheater in Vienna (December 8, 1881) demanded the lives of 449 persons, of which 284 could be identified, many with the help of dental data. Another fire in Paris, 1897, demanded the lives of 126 persons. There were many dentist to help in this case. Monsieur **Oscar Amoëdo** (1863 - 1945), who was a professor in the Ecole Odontotechnique de Paris, became interested in the possibilities of the dentists to identify burned bodies and collected the results in his dissertation: *L'Art Dentaire en Médecine Légale* (1898). With this in mind we can call Amoëdo as "the Father of Forensic Odontology" (Keiser-Nielsen, 1963).

On Monday, August 23 1993, right after the 13.30-14.00 Opening Ceremony of IOFOS by Dr.Dr Klaus Rotzscher, President, there are lectures to be held by the French colleagues with respect to the history of Forensic Dentistry; starting with the 1897 "Bazar de la Charite"-fire , by Francoise Raffa and **Michel Evenot**. No doubt of the scientific standard of the presentation, Dr. Evenot made his dissertation by reconstructing "Birth of the Modern Forensic Dentistry". As *Appendix # 5* we include by courtesy of Dr. Evenot the cover pages of the bibliographical rarity, the *L'Art Dentaire en Médecine Légale* by Masson et Cie, Éditeurs, Libraires de l'Académie de Médecine, Paris.

See Appendix # 5 (Courtesy: Dr. Michel Evenot, Paris)

2.2. Fingerprint Identification

There are plenty of ways to identify human beings. Many of them are valuable aids in DVI work, but only three of them could be described as extremely accurate. Both teeth and fingerprints have helped the investigators about one hundred years. DNA has just started about eight years ago

Not until 1880 was the criminalistic use of fingerprints publicly proposed. The suggestion appeared in the British journal **Nature**, in a letter from Dr **Henry Faulds**, a Scottish physician working in Tokyo. Faulds suggested that fingerprints found at the scene of a crime could provide positive identification of the offender.

Henry Faulds, Nature, 1880

In the 90's Automated Fingerprint Identification System (AFIS) Communications promise a computerized connection between the various international DVI-Teams. In the Adelaide Version of this paper we erroneously mentioned, that "there already exists a program, which makes Printrak Orion, NEC and Morpho, the market leaders in this field, discuss with each other." - This was only hearsay evidence, a misconception, and is not true. The algorithms ("A precise statement of a method of calculation. It can sometimes be expressed conveniently in a programming language") of the systems are tightly protected commercial secrets, and therefore we can not send them as such over the communications lines. This is possible only, if you happen to own the same kind of system

Commercial Secrets

Because the codes are different and incompatible the National Institute of Standards and Technology, NIST, has developed a system of High Resolution Grey Scale Fingerprint Data (500 pixels per inch, 256 Grey Scale Values, 0 is Black, 255 is White). The standard, *Data Format for the Interchange of Fingerprint Image Information*, is not yet ready for use According to the NIST Workshop on the Electronic Exchange of Fingerprint Images, March 4-6., 1992 Gaithersburg, Maryland, a Wavelet Scalar Quantization (WSQ) Open Architecture will be adopted as the framework for grey scale compression/decompression. The FBI develops a parameterization certified for fingerprint images quality, and the FBI designs a segmentation algorithm prior to operational use of any compression. The FBI, California, Missouri and North Carolina are representing all three AFIS vendors.

Printrak Orion™ MORPHO™ NEC™

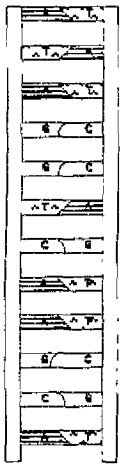
2.3. DNA Identification

One hundred and five years later than Dr Faulds, 1985, in the very same scientific publication, Nature (Vol. 318 12 Dec 1985, p. 577-579) appeared an article: "Forensic application of DNA "Fingerprints"", written by *Peter Gill. Alec J. Jeffreys & David J. Werrett.* - It took about 40 years before fingerprinting was fully operational for identification. The English and the Americans (the Home Office and the FBI) invested in the criminalistic application of DNA so much, that in less than four years it had spread over the globe to the advanced crime labs of the law enforcement communities.

Alec Jeffreys, et alii, Nature, 1985

The Council of Europe gave a *Recommendation* about the use of DNA-Identification within the Framework of the Criminal Justice System in 1992 That paper included a terminological remark, that the metaphor, which the aforementioned three eminent scientists had used and coined (note: they used it in parentheses), was somewhat misleading. We share the same opinion. The X-ray DNA-patterns, which are compared, have nothing to do with the minutiae patterns of the fingerprints or the patterns made by the barrel grooves in the bullets to be compared in the microscope. They are not called "Bullet Fingerprints". Some people use the expression "DNA-Profile" and speak about "DNA-Profiling", but this is also incorrect. Identifica-

Use Coherent, Logical Terminology!



tion and Profiling are not synonyms. A Terrorist Group or a serial murderer has a "Profile", but not DNA, fingerprints or the toolmarks of the gun. Have you ever heard of "Dental DV Profiling"? - No. It makes much more sense to use the following coherent and logical terminology. Dental Identification, Fingerprint Identification and DNA Identification.

The Finnish DVI-Team has applied this technique in connection of tree flight accidents and one hotel fire. In the first case there was no success, partly because of lack of experience and partly because the bodies were heavily formalinized. In tree other cases we succeeded, but it took too long to get the results. In one case the samples were taken to the FBI-Laboratory, too, where the DNA-Expert of the Finnish DVI-Team, Mr. *Antti Sajantila*, was working in June-July, 1990. There a new probe (240 kB, **HLA-DQ** α) was used. Body parts could be excluded even by DNA-Identification, they did not belong to a Finnish citizen killed in a Flight disaster in Honduras. To commemorate Antti Sajantila's criminalistic work as the writer of the first dissertation on DNA-Identification we include here as *Appendix # 6* the title page of his book, *"DNA Analysis in Forensic Medicine : Application of the Polymerase Chain Reaction, PCR, to the Identification of Individuals"*, Helsinki, 1992.

The Norwegians used DNA-Identification in the Scandinavian Star ferry fire (arson) in 1990. The English have used it in the context of the two recent Nepal crashes. The results are mostly unknown to the forensic community. Dr. *Peter Gill* (Aldermaston) stated just a few days ago in a telephone conversation, that due of the various difficulties both in the AM and PM side there were not very many identifications done.

At the best the proper procedures take still a long time and the total cost is much, much more than comparing with the dental journals. There will be samples needed from the suspected victims, the parents, or the widows and the children. Some religions make difficulties to get the comparison material. DNA-DVI-ID is not yet a routine method in any country. The situation is different, if you, like the US Defense Forces do have since the beginning of 1992 a database for all personnel (2,5 million men and women)

There has been misconceptions about the DVI-use of DNA, even *Quasi-Expert* lecturing. We must beware of this kind of bluff. Trust the Real Experts like Dr. **Samuel Baechtel,** who has written a paper "*The Potential of DNA-Typing in Disaster Situations*". A copy of the interesting study can be ordered by writing a letter to Federal Bureau of Investigation, Washington, D.C., Assistant Director in Charge of Laboratory Division, **John W. Hicks**. Thanks to him and Dr. **Bruce Budowle**, Dr. Sajantila got his dissertation ready and made with them an excellent and valuable population study. It proved, that the Finns, who are an isolated group of people, having climbed down not so long ago from their big forest trees starting to use axes, are just like the Americans having enough variation for DNA-Identification purposes.

2.4. Dental Identification - Theoretically Evidential Power of Astronomic Probability

The dentition possesses an enormous evidential power. And unlike with fingerprints, with teeth it is possible to give exact figures based on mathematics only. However, the need to make population studies like in DNA-Identification, whereupon to base these magic calculations, remains as well with the fingerprints as with the teeth.

With modern AFIS systems it is possible to gather data of the frequency of different patterns and characteristics. The more frequent a characteristic is, the less information it yields for the investigator. The same applies to dental characteristics. Just like one eyed, battery operated (equipped with a pacemaker), single handed, Eskimo taxi-drivers in Adelaide, South Australia. is possible to target, similar rare features can be found in the mouth. This is the strength of the Simple Search Systems. They will be in trouble, if the material is more homogeneous. It makes also sense to study the real environments. This is nowadays possible with computers. The U.S. Army Institute for Dental Research, USAIDR, has a vast database. Not only are all 2,5 million people of the Armed Forces registered with their DNA, but also the same amount of 10 fingerprint cards are available (not yet computerized?) as well as the computerized dental data. But let us first look for the arithmetical possibilities, calculated with a microcomputer in Sweden.

Our good friend and teacher of the Finnish DVI-Team for about 15 years, Professor (of Forensic Odontology) *Gunnar Johanson* from Sweden, has written a book on this subject with *Dr. Håkan Mörnstad*.

Gunnar and Håkan present in their "Kompendium i Rättsodontologi" (123 pages, plus appendices 40 pp. in 1986) on page 28 the following two tables.

"Possible variations when a cumulative amount of teeth is missing in a 32 dentition.

Table # 1

Number of Teeth	Variations	Number of Teeth
1	1	32
1	32	31
2	496	30
3	4.960	29
4	35.960	28
5	201 376	27
6	906.192	26
7	3.365.856	25
8	10.518.300	24
9	28 048.800	23
10	64.512 240	22
11	129.024.480	21
12	225.792.840	20
13	347.373.600	19
14	471.435.600	18
15	565.722.720	17
16	**601.080.390**	

Possible variations when a cumulative amount of teeth surfaces are filled in a 148 surface combination:

Table # 2

Surfaces	Variations	Surfaces
	1	148
1	148	147
2	10.878	146
3	529.396	145
4	19.190 605	144
5	552.689.424	143
	~¤ ~¤ ~¤	
10	$1.0*10^{15}$	24
20	$2.7*10^{24}$	23
30	$2.1*10^{31}$	22
40	$2.4*10^{36}$	21
50	$8.9*10^{39}$	20
	~¤ ~¤ ~¤	
74	$2.3*10^{43}$	

This evidential power is extremely exact and good. Only two logical possibilities. Tooth/ Restoration Yes or No Compared with any other identification method this is superior, having the luxury of straightforward calculations possibility . And the probability will be $2.3*10^{43}$, which is 2.3*10 Million *1G*1G*1G*1G. Gigabytes (1,000,000,000,000,000) after Gigabytes after Gigabytes Not even the Minister of Finance or the Chief of the Greenwich Observatory can easily understand these huge figures *"Det kan därfor med allra största säkerhet påstås att inte två tanduppsättningar ar varandra lika"* says our source, which means in English:" It can be argued with the utmost great probability, that no two dental statuses are alike."

We must although recognize, that this kind of calculation is not empirical evidence. Empirical proof and probability numbers can be derived from population studies. This has been done recently in Finland with disaster and air force material. They present the necessary random samples to get a prima facie idea of the variations in real life (and death).

And, on the other hand, as already cited. Mr. **John Maynard Keynes** stated: "*The probability is such a degree of rational belief, which not necessarily can be put in a measurable form*" - So, after all, we do not need **any** statistics, when deciding things to be "beyond reasonable doubt "

2.5. The Unbeatable Advantages of Dental Identification

The advantages of dental characteristics for identification are obvious: they are **individual specific**, **destruction resistant**, and there are millions and millions patient **files available**. Criminals and Non-Criminals. Fingerprints are in most places taken only from crooks, although some Interpol member countries have good register systems for military and civilian (driving licences, ID-cards, bank employee registration etc.) use too.

2.6. Simplicity, the Ideal Dental Computer Comparison Factor

32 + 5

(M, O, F, D, L)

The actual forensic dental identification is based, if possible, on the morphological comparison of the dentition. Even this can nowadays be done with the computer and laser beam (at least in the USA, of course). But the real power lies in the simplicity and numerical comparison. The human dentition has 32 tooth positions and each tooth can be divided into five surfaces M, O, F, D, L. This suits well for the computers. Simplicity is the Ideal (Computer) Comparison Factor - Think about the totally different situation with fingerprints: the topography of a print with measurements and various minutiae is extremely complicated to be accurately described for computer comparisons. We are dealing here with **topology**, the science of features and shapes, not simple numerical data.

General Field Marshal **von Hindenburg**

"*In war only what is simple can succeed* ", this principle of General Field Marshal **von Hindenburg** (1874-1934), is very true also in DVI. - The only problematic thing is such a disaster we had here in Finland some twelve years ago: a fire in a retired, old peoples hospital. Among the 43 over 80 years old victims there was only one (1) tooth left altogether. Others had full (unmarked, of course) prostheses! When we started to test-drive our brand new dental identification program IDENTIFY 1.0 ©with old domestic DVI cases this happened to be the first one in the row. The data entry did not take too long, neither did the running of the comparison program.

32 + 5

(M, O, F, D, L)

General Field Marshal **von Hindenburg**

CHAPTER 3. DVI COMPUTERIZATION OVERVIEW

3.1. Computers, General Tools in Criminalistics

The Law Enforcement started to use computers more than 30 years ago. Today computers are general tools in criminalistics. It is no wonder because generally information management is strongest in information-intensive enterprises. Investigation in general is similarly information intensive and disaster investigation in particular.

Victim identification is besides practical steps mostly applied informatics, collecting and analysing information. On the Disaster Site as well as in the ID-Center. Processing the reputed facts which may reduce the size of the frame to get evidence. Information is **transformed into evidence** by an assessment of its relevancy to the ongoing investigation. The degree of relevancy has a spectrum ranging from total irrelevancy to total proof. The evidence has to be strong enough to justify identification. Good AM- and PM- data allows the investigator to concentrate his efforts on a comparatively restricted number of options.

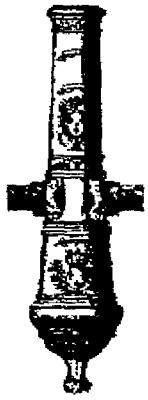
When the art of Risk Management is combined with disaster handling procedures and techniques we will get Crisis Management. The computerized Crisis Management System of the UK-Police is shortly described here a little later (see under 3 3). In the IOFOS/Düsseldorf program presentation # 57 on Thursday afternoon, August 26, (Chair: Dr. Dr. Marianne *Hagen*, Neuss, Germany and Dr. Tore *Solheim*, Oslo, Norway) describes it in more detail : "The Use of Computers in Management of Disaster - CRISIS: A Hong-Kong View, *Leung, Carl*, Hong-Kong."

I·O·F·O·S

The thinking behind the system seems to be very sound. An efficient Emergency Plan is a plan for survival, particularly when refined and practised It can turn a potential disaster into much less serious incident. But on the other hand: an ill-conceived and untried plan *(or no plan at all)* will almost certainly transform an incident into a catastrophe. When we are contemplating the horrors of the modern accident with passenger lists numbered in hundreds, we have to be organized in advance and ready to deploy not only very many officers but to equip them with the best tools available. And this means today computers. They have been around long enough.

Computers, Crisis Management "Artillery"

We have to be prepared for the worst. the difference to minor accidents is only the need for lesser resources. And according to General **George S. Patton**: *"A good plan today is better than a perfect one tomorrow"* And according to the gentleman, whom **Carl von Clausewitz** calls "The Master": *"The God is on the side with the best artillery"*. In Disaster Victim Identification the decisive strategic tool, like the artillery for **Napoleon**, is a good computer system. But, Nota Bene, like the gunners, the users of the computerized DVI-systems are worthless without proper training



Dental identification programs are only a part of the DVI procedures. But a very essential part. They are the real timesavers and workhorses. The statistics of many cases show clearly the importance of having a good, accurate forensic dental program in place before a disaster occurs. not after "**If the software is not available, neither is the service**"- is the motto of our system. And we do not mean this back-bone piece of software alone, but the whole software and hardware configuration with many other programs and devices. And the good news first: the sophisticated tricks pertinent to DVI-work done with the mainframes earlier can today be played on micros as well. **This makes the computerized DVI affordable to all Interpol member countries.** A system that works will cost in its basic configuration only about 2.000 USD. One could even add, that the days of the dinosaurs, are over.

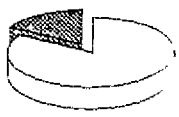
Programs In Place Before - Not After

When we look the CADVI systems of today we shall see many other applications than odontological in this difficult, multi-disciplinary effort. Computers of many sizes and with a plenty of programs are used in almost every stage of the investigation: Scenario Analysis, Planning and Training, DVI-Team Resource Database, Alarm Tool and Logbook, many Search and Rescue purposes, accident (crime) scene sketching and charting, collecting and processing the AM- and PM-information, printing lists, forms, certificates, manuals, reports, communicating (by E-Mail, Fax, even Desktop Videoconferencing), presenting etc., etc , etc.

Not One Application Only

3.2. Cost / Benefit Calculations

Computers help the work to be done more effectively in all fields of human life. No one would even think to go back to the manual days in banking, administration or science. Simply because the Cost/Benefit calculations so clearly show the advantages of computers to the decision makers



The criminal investigation is time intensive in general, so is the DVI work. The maxim *"Time Lost, Truth Lost"* is valid in both of them. Both are money intensive. Normally people do not figure out that the salaries are the real cost. If we think a little closer we can visualize the difference even without using a spreadsheet program to convert the time and dollars to a pie or bar chart.

The price of some microcomputers, peripherals and software is just peanuts in the whole bankruptcy. The Interpol DVI Manual cites an old Canadian case, which took **6 weeks** to go through. It is self-evident that the real cost, salaries, many times exceeded the cost of the implementation of a computer aided system. In Detroit, Michigan, they did it some years ago in **6 days**; 129 of the 165 victims were identified by dental records

6 Weeks or 6 Days

With manual methods the productivity is much worse and the standard of the results is lower. With the proper tools the same amount of effort gives totally different output because in DVI there will be a tremendous amount of information gathered and a high pile of documents created. Without computers the work seems today to be waste of three things: energy, time and money. Even "minor disasters" with 10 victims are handled much faster and more smoothly with computers. Manual methods just don't make sense any more. Today, like some ten years ago, we do not need any more expensive mainframes or legions of computer experts to write new custom tailored programs. Ordinary micros, be it IBM PC, a clone or Mac, will do. So, the new cost cutting tools can be used in any Interpol member country in every corner of the world.

WARNING!!!

The mention of commercial product names or services in this presentation should ***not,*** *under any circumstances, be interpreted as an endorsement or approval by the Finnish DVI-Team of any particular product, service or equipment.*

3.3. Computer Aided Disaster Victim Identification Systems, CADVISYS, of Today

3.3.1. Mainframes

UNITED KINGDOM

Mark Rand, Chief Superintendent, of the West Yorkshire Police, a member of the Sub-Committee set up by Interpol's Working Party on Disaster Victim Identification, described this computer system to help police cope with major disasters in the International Criminal Police Review (ICPR), July-August 1988 number, as follows:

CRISIS

"Essentially, **CRISIS** absorbs detailed descriptions of missing persons and dead bodies and then compares them. The vague nature of the ante-mortem information in particular makes it essential that CRISIS does not eliminate the apparently impossible on a particular characteristic It has a facility whereby the parameters for comparison can be varied to suit the circumstances of the disaster. Thus, for a fire, height and weight may not be too relevant and a wide variation can be pre-set. Dental chartings are compared by CRISIS using the Federation Dentaire Internationale (FDI) system of dental charting. This is the Interpol standard and the one which is becoming the most widely used of the six or more main dental charting systems. When ante- and post-mortem data are input, CRISIS will suggest the more likely matches in descending order of probability. For physical features such as height, weight, colour of eyes, etc., the system lists these characteristics as "hit" or "miss" within the set parameters for the disaster. On dental matching it shows a mathematical match on an arbitrary points scale. It will also print out graphics of the charts for expert scrutiny .

About one thing one must be quite clear - CRISIS suggests matches and lists its evidence Thereafter it is up to a team of experts to review the case and to agree or disagree with the suggestions of CRISIS. The computer can only be as good as the information with which it is supplied. Even ante-mortem dental charts have been found to be less than totally accurate. CRISIS goes some way to compensate for this by not eliminating the apparently impossible Thus, a tooth shown on an ante-mortem chart as extracted but which is very definitely present on the dead body is not rejected in the matching process. The system also accepts that occasionally dentists have been known to mistake left from right. Even so, there comes a point where the computer cannot replace human guile, intuition and experience.

Besides the matching processes described, there is an English Search Facility whereby the entire database can be searched for a particular word. For example, the database could be searched for RED garments or, say, AMERICAN EXPRESS cards, in an effort to do very quick matches on individual bodies when compared to the missing and unidentified persons. Another large element of CRISIS is its administration package. Such mundane, though important, matters as records of hours of duty worked by people on the enquiry, costs and statistics are catered for."

A couple of years earlier Mark Rand reported about the details of the dental comparison in connection of the Bradford Football Ground Fire Disaster (1985) as follows (Police Review, UK, Sept. 1986): International (FDI) system of numbering is used, this being the most widely used of the 12 or so worldwide systems The existing Interpol forms did not allow for deciduous teeth, but the CRISIS modified forms do. For input on to CRISIS each tooth is described in terms of its status (present / absent / filled / bridged / crowned etc.), the filling material used,

the crown material and which of the five tooth surfaces have been treated. Dentures, bridges, orthodontic treatment and mouth features are also described Given the possible variables, any one tooth is capable of being described up to 44 ways. - Multiplying that by the number of teeth being examined in the disaster gives an idea of the gargantuan calculations being performed by CRISIS when matching teeth. The system took about 15 minutes to compute the dental data of the Bradford fire victims. It awards points for similarities and displays the possible identities for each victim in descending order of probability."

P.M. McLellan , Assistant Commander, Director of Informatics, **Royal Canadian Mounted Police** , Ottawa, Ontario, described the Canadian model in a letter to the Finnish DVI-Team as follows:

"In order to give you an appreciation of how the Royal Canadian Mounted Police handle major disasters, such as aircraft crashes,---, with a brief description of each of the major software systems, that we use in the support of such investigations. The **Police Information Retrieval System** (PIRS) --- is, by its nature, a very powerful and dynamic indexing system ideally suited for handling tactical, as well as strategic requirements, that are ordinarily associated with the investigation of major disasters, such as aircraft crashes. The PIR System has been used with great success in many of our major investigations, including the investigation of the crash of the U S Military aircraft in Newfoundland in December, 1985.
The Divisional Information Bank (DIB) System --- is a large-scale text processing system that we use for operational, as well as administrative, support in major disaster investigations. DIB, which is a full on-line text-document- retrieval system, provides the investigator with the facility to store the full text of his investigative material on the computer, so that every character of every word in every sentence of every document can be located by the computer. This system is well suited for cases where it is necessary to examine and coordinate large amounts of free text, reports, etc. It has been our experience in handling major disaster/criminal investigations, that a combination of the PIRS and DIB Systems provides the investigator with not only the necessary administrative and decision making support functions, but also supplies accurate and timely information to assist in making the best possible decisions under the circumstances.

RCMP, Canada, Divisional Information Bank (DIB) System

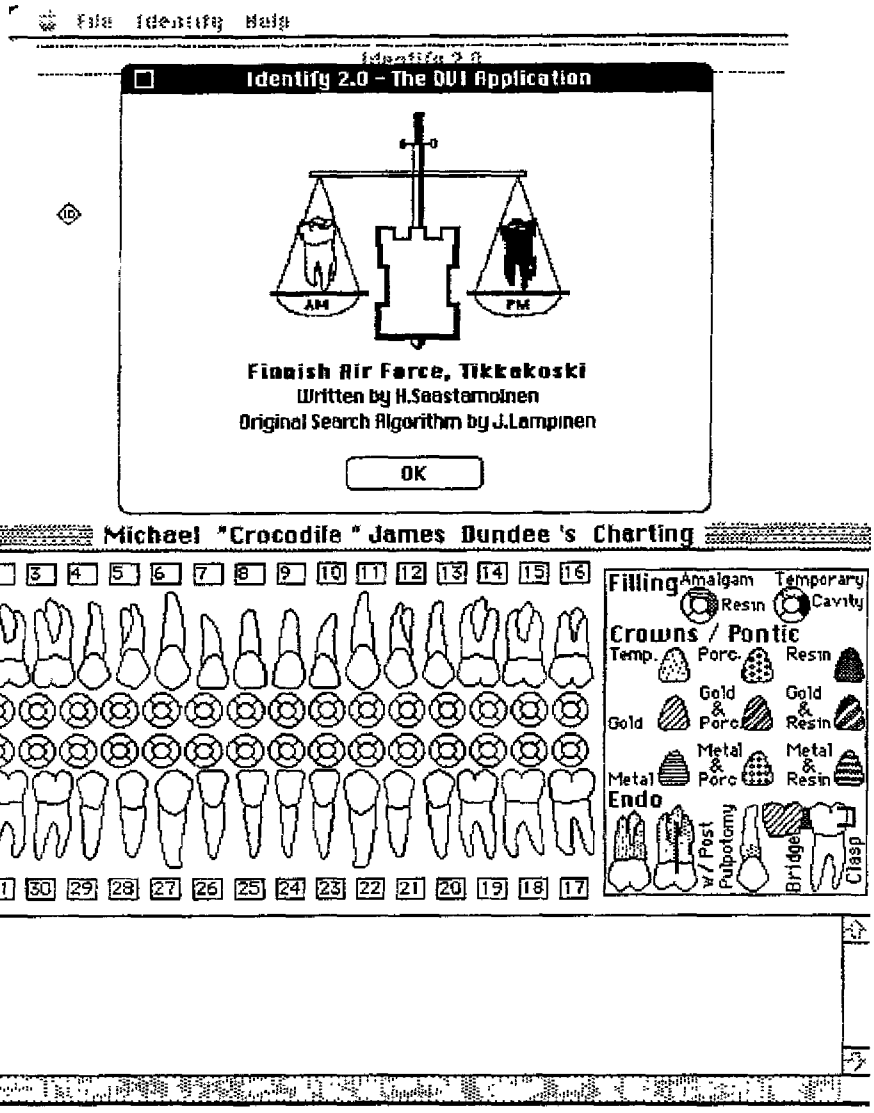
The CPIC Persons Sub-system, which includes a Dental Characteristics Category that stores individual **dental records** in similar form to treatment **charts** maintained by dentists for their patients, is used to support our investigators responsible for the identification of disaster victims, in the aftermath of major storms, earthquakes, fires or aircraft accidents where loss of life is heavy, and the condition of victims hinders normal identification. In these circumstances, coroners may arrange charting of dental characteristics for use by police investigators ---.
Although, I have only touched briefly on a few of the many computer systems that we use in support of the current needs of the Royal Canadian Mounted Police, I hope that I have given you an idea of the type of computer support, that the Royal Canadian Mounted Police is providing its members involved in the investigation of major disasters.

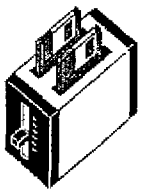
IOFOS Newsletter, June, 1993, page 15, describes the progress of the application as follows: "DIP-2: A Canadian Computer Aid to Mass Disaster Dental Identification" - There have been numerous computer programs designed to aid dental identification in mass disasters. Their development was initiated by a similar need and therefore outcome of each is similar. However there are differences, and these differences represent a need to use a special language, a particular dental nomenclature or meet the unique requirements of forensic specialists in a particular country."

I·O·F·O·S
NEWSLETTER

Sorry to interrupt, but here is the nucleus of the poodle, in original German: *"Des Pudels Kern"* - All character oriented systems, be they on mainframes or PC's, will inevitably encounter troubles with nomenclatures. Because they are character oriented they cannot avoid this letter and number acrobacy. We dare say acrobacy, because learning those forensic expert codes is as smart as learning the telephone book of Sydney, Australia (made of first class Finnish paper) The advanced Infirmation Technology (IT) answer to this NOMENCLATURE PROBLEM is simple: **KISS!**

With ToothPics&Identify 2 0 you can forget this mess and Babylon of secret codes. Believe us. with the Graphic Interface you do not need at all the 50 or so existing "official" nomenclatures, be it Canadian, Russian, Italian, Japanese, Chinese or any other Dental Authority! The nicety with all kind of standards, dental and the others, is that there always will be too many around. Please, all Character Oriented People, take a look at the elegant solution here:





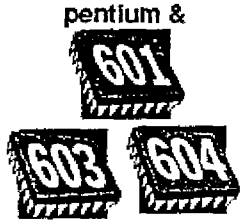
With the simple graphic man-machine interface you just point and click the surfaces and the other "buttons". If you can use a toaster, you can use ToothPics & Identify 2.0

But let us absorb some more information about DIB 2: "One of the first computer-aided systems was developed in Canada in 1972. Two years later the basic logic, input and output forms of this system (DIP-1) were adopted by CPIC (Canadian Police Information Centre) and thus Canada had one of the first on-line Dental Identification Programs in the world When the province of Ontario appointed a Dental Team for mass disasters in 1987 it became clear that the CPIC system was neither practical nor portable and would not meet the needs of forensic dentists. After evaluating some of the other available systems it was decided to rewrite and redesign DIP-I. The new program (DIP-2) is written with a clear and precise user interface. File management is internal and keyboard choices are limited and consistent. Keyboard data input was tested by non-dentists, who found the program straightforward and friendly. The only dental discriminating factors are Tooth Present, Tooth Missing, Tooth Filled and Unknown. Age and sex are used when known. In an objective test, DIP-2 eliminated and resolved identification as efficiently as CAPMI (U.S. Computer Assisted Postmortem Identification - by Lewis Lorton, K.R) We believe it is easier to use, offers simultaneous AM/PM on-screen displays and produces lists of identified AM and PM records, features which are not available in CAPMI. CAPMI does allow sorting of deciduous teeth and can prepare batch comparisons Presently,

DIP-2 does not. The goal of the developers was to design a system for PC application with excellent interface, sufficient power and speed and enough discriminating features to reduce input errors and have a high degree of validity. We believe we have accomplished this task. A test of the system using AM/PM records of an actual air crash with severe fragmentation proved the program highly dependable and efficient. The program is written for PC-IBM MS-DOS. Further information regarding availability of the program can be obtained by writing to: Dr. S. KOGON, Faculty of Dentistry, Division of Oral Medicine & Radiology, The University of Western Ontario, LONDON, Ontario Canada N6A SC 1".

Even after seeing Steven Spielberg's "Jurassic Park" we believe the dinosaurs are dying. DVI-Teams are shifting to personal computers. No wonder, because the current micros have more kick than the mainframes of yesterday. The next revolution with RISC PowerPC's and Pentium PC's will enhance the horsepowers by approximately five (5) times already next year. Dr. *Marianne Hagen*, the first person to write a dissertation about computerized dental DVI in the world, will lecture and demonstrate with St. J Srack under item # 58 the same evolution in Germany: *"The Computer-Quadrant -Method Running on a PC"*.

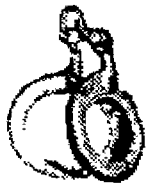
Intel pentium &



3.3.2. Microcomputers

Various programs have been developed for microcomputers by various DVI-Teams around the world. They differ, as mentioned earlier, for user interface, comparison criteria and comparison modes. As far as we have succeeded in collecting information about, the Swedes call their program ODISYS (alias Ident), the Norwegians VISTA and the Dutch RITSYS The name of the Danish one is still unknown, but the Belgian system has got the new name of IBIS. The Australian one is called ODONTID.

Different DVI-Teams, Different Solutions



In our Ad Hoc Strategy Model, in the Column of Collection and Analysis of DVI-Experience, stands as very high priority the Collection of Computerized Systems. The descriptions and manuals with the diskettes of all these systems should be sent to the Interpol Standing Committee, but this alone will get us nowhere. There must be some DVI-data to be fed into the programs before they can run. And this data can be collected like we have presented earlier We already have a big database of dental data, with which to test the systems, but it is only a part of the whole problem Other than dental data has also to be collected. If not, the evaluation of the various programs is not possible. If there is no evaluation, there is not much hope of progress. As stated before, these two are linked together like the clients of the U.S. Marshals Service.

There are very likely some other "unknown" programs in Europe alone. As far as our information is correct all the programs mentioned before, including their mainframe brothers, have **code oriented** dental data entries. They perform **only semiautomatic**, simple searches, where the forensic dentist keys in successively dental characteristics, which in turn reduces the frame of the possible matches Many applications are basically standard off-the-shelve or police database programs, used for this function. Some ingenious dentist, like the Norwegian **Ove Sakshaug**, have programmed this feature by themselves. Unfortunately our learned friend died before he could finish the VISTA application totally. The Belgian IBIS is an exception and has reached real Top Ten Automation, like the "industry standard", CAPMI. We have not been able to run the IBIS program yet , even we have got it and the French/Flemish manual plus seen a demo in Brussels in June, 1993.

As far as we know there still exists at the moment only three fully automated systems for mainframes or microcomputers. With this we mean programs, which produce Top Ten Hit Lists in the order of probability, just like their counterparts in the Automated Fingerprint Identification Systems, AFIS, the Californian DeLaRue Printrak Onon, the French-IBM Morpho, and the Japanese industry giant NEC. CAPMI, currently under Windows, Version 4 0, has not yet a graphic interface. ToothPics 2.24 &Identify 2 0, which is a product of a Joint U.S.-Finnish Project still under further enhancement, will be described in detail in Chapter 4 below. The current version of our program package is also fully compatible with CAPMI ToothPics 2.24 generates a file that can be transferred to an IBM PC and then be sorted using the CAPMI program, if you like. The idea is similar to that, what Gaius Iulius Caesar used with his legions: *the tactical reserve*, the Cohorts of the third line

Simple Searches versus ***Top Ten Hit List*** *Approach*

Testing in Tempe, Arizona, with 165 AM-PM dental charts, (July 1990)

In a test in Tempe. Arizona. with 165 AM-PM dental charts (of the Detroit 1987 Flight Accident) the results with CAPMI and Identify programs had almost identical Top Ten Hit Lists. The only difference in test results (July 1990) was that CAPMI was slightly slower. It was actually anticipated that our US-Finnish DVI-program beats CAPMI clearly only in the data entry phase. CAPMI system uses either optically readable marked forms or cryptic codes to be learned, instead of a charting system that allows non-computer experts to operate in a matter of minutes.

Although CAPMI is available to forensic experts throughout the world for free, to our knowledge almost all uses of CAPMI have been performed by the U.S. Army. Most of the forensic dentist are obviously too lazy and try to avoid learning tens of program specific, cryptic codes. And in critical situations there simply is not enough time to start learning complicated things. Just remember von Hindenburg: only simple solutions will succeed. Under stress you get frustrated easier than normally.

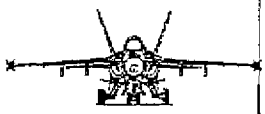
Col. LORTON, U.S. ARMY

CAPMI was created by Colonel Lewis Lorton, the former Chief of Bioengineering Branch and Research Dental Officer, U.S. Army Institute of Dental Research. Lorton has written several outstanding articles about the decision making concepts, design and use of computer assisted postmortem systems. CAPMI was first published in the Journal of Forensic Sciences in July 1988 (Vol 33, No 4, pp. 977-984). The abstract is worth to be cited here:

"ABSTRACT: The Computer-Assisted Postmortem Identification (CAPMI) system was developed at the U.S. Army Institute of Dental Research to facilitate rapid identification of human remains. The increasing requirement for dental based identification of high-energy fatalities and decomposed remains has dovetailed with the development of computer capabilities permitting automation of most of the highly repetitive chart-by-chart screenings characteristic of traditional identification taskings. This report summarizes the concepts upon which CAPMI is based, describes how it works, and reviews suggested applications and limitations. CAPMI software is available to governmental, civic, or humanitarian organizations at no cost.- KEYWORDS: odontology, computers. information systems, forensic dentistry, computer identification".

Identify ©
Finnish Air Force

The ToothPics System, as used in the recent flight accidents described a little later here, did not have the automatic suggested suspect list that the CAPMI system offered already in its original version eight years ago This full automation feature (**Identify**) was created by Captain **Hannu Mäkelä** , Finnish Air Force, and a programmer, Flight Pte J. Lampinen, serving his military duty in the Air Force HQ. They studied the material and concepts of Col. Lorton and the USAIDR in depth and after three months of hard programming with Turbo Pascal Identify was ready in August 1989. It almost collapsed a month before, when a major, being of higher rank than our captain, took the programmer private for better jobs offered by him. Luckily then a wise colonel stated as follows: "A soldier reaches his most stupid stage during his career as a major." The programmer was returned for the Identify-project and soon the software was ready to beat its model and predecessor in some important aspects as ease of use. The newest version 2.0, written by H. Saastamoinen, also serving then in the Air Force, is fully in English You will notice that later, if you still have energy left to read forward with this paper.



F/A-18 Hornet
US&Finnish Air Force

Speed in comparison is not as essential as the program learning curve for novices The average Teach In time for the Finnish DVI-Team military dentists (some of them to be considered totally computer illiterate before) in creating their own dental statuses both in graphics and text format plus printed with laser has varied in practice from 8 minutes to 28 minutes.

Fewer Boys - Better Toys" as one modern age military man put it (not the Great One from Iraq) A small group of well equipped and competent people will put us in a better position than the rest of the law enforcement forensic services in the whole country.

The world records in learning our system does not come from Finland. No. Not at all. Some months ago we visited Paris and the French Ministry of Interior. Dr. *Michael Evenot* learned ToothPics&Identify with a Powerbook 180 in about three (3) minutes. Then a few weeks ago when visiting Jerusalem and the Israel Police HQ, even this World Record was beaten. Professor *Sela*, an experienced CAPMI user, set with the same equipment the ultimate: only two (2) minutes!

All Programs Are OK

All of the programs mentioned here do their job. There is no need to force any DVI-Team to change their way of working. If the Germans, English and Canadians, for example, are happy or unhappy with mainframes, so be it. If the Norwegians like their VISTA, its all OK. The Belgian Gendarmerie has obviously an excellent solution for their purposes, like the Aussies with the Adelaide Forensic Dental Unit application.

Play with Standardized Cards - THE INTERPOL FORMS!

The only thing important is to use the new Interpol FORMS They are the basic Information Management Tools They suit very well in every environment, be it mainframe or microcomputers. The 1989 General Assembly recommended that all the Organization's member countries use Disaster Victim Identification Forms in all appropriate circumstances including cases in which there is only one victim to be identified. The reason behind is the necessity to standardize the international exchange of AM and PM Data. This is done only if we all play with the same cards. This might take a long time in real life. Much confusion has been around, because people are not familiar with DTP and Forms programs. Last month we sent to Interpol Beijing the Forms on a couple of diskettes in PageMaker, which had the English and the German texts. It is only a matter of hours to put Chinese instead of the German.

The FBI Academy (Quantico, VA) arranged "*An International Symposium on the Forensic Aspects of Mass Disasters and Crime Scene Reconstruction*", June 23-29, 1990. The program was very comprehensive and very forensic, but not a single word was mentioned about the New Interpol Disaster Victim Identification Forms! We do **not** want to be any kind of "*Besserwissers*", but someone has to point out **the benefits of uniformity.**

Or perhaps we have forgotten the Botany Bay, 1961, where the history of the Forms started. But, on the other hand, some people who have used the Interpol DVI-Forms, say, that "a great deal of paper is wasted when around two thirds of the form is unused because no answers can be given". Never mind the paper problem, there will be no shortage, Finland produces it much, much more than you ever can waste in your DVI-Work.

3.3.3. Synergy by Connection

The connections between micro, mini and mainframe computers can create synergy of the whole effort. **Access to** different **databases** is vital to shorten the time needed in collecting the AM-data. It is not so hard to imagine, that without AM-data there is no possibility whatsoever to make comparisons. It's like rowing with one oar only. The result is circling in the same place. This special navigational manoeuvre bears the attribute vicious.

Linking the individual productivity tools on PC's and Macs might make sense, too ToothPics® and IDENTIFY© and CAPMI can actually play together. Technically there are many ways to the MS-DOS - Mac connection for data sharing, networking and support: telecommunications, electronic mail, links and external drives, internal drives etc. Mac Link Plus meets most of DVI-data sharing needs, it offers a complete solution: hardware connection, software for both machines, and translation capability. It doesn't require you to know much, if anything, about communications. The Macs with SuperDrives have been reading and writing 3,5 inch MS-DOS and OS/2 disks since 1989. If you like you can buy a mac-board for your dos-machine for less than 1.000 USD, but it does not make too much sense, because you can get the Mac with 600.

There are also on the market some programs (like the Swedish-made HAT, Highspeed Analysis Tool), which can rapidly swallow huge amounts of data from mainframe databases and process them in the RAM memory of a desktop Macintosh. The analysis results come out in seconds This would, for example, allow the rapid search of medical data, in case the information is stored in different hospital systems.