15th Meeting of the International Association for Craniofacial Identification

Facing an African Experience

3 - 7 August 2013

Mopani Rest Camp
Kruger National Park
South Africa

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Faculty of Health Sciences

FARC
Forensic Anthropology Research Centre

IACI
International Association of Craniofacial Identification

Forensic Anthropology Research Centre

The Forensic Anthropology Research Centre is housed within the Faculty of Health Sciences, University of Pretoria. Its aims are to produce research on all aspects regarding recovery and study of human remains, to provide professional anthropological and archaeological services and contribute to education and training of students and other professionals.

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Conference Proceedings

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Message from the Organizing Committee

It is with great pleasure that we, on behalf of the University of Pretoria and the South African Police Service, welcome you all to the 15th Meeting of the International Association for Craniofacial Identification. It is our sincere hope that you enjoy this African Experience in one of the most beautiful parts of our country. As always it is a great joy to see old friends again, and to meet the new and upcoming generation of scientists and practitioners.

The conference focuses on research and practical applications in the field of craniofacial identification, and has a distinct African flavour with many of our local colleagues presenting reports that reflect their daily experiences in this complex field. We are especially indebted towards all workshop organizers and plenary speakers who may not all be regular attendees of this conference. Your efforts are much appreciated. We hope that everyone finds the presentations and discussions stimulating and of practical value in their daily work.

In drawing up the programme, we have attempted to leave some room (especially early mornings) for exploring the surroundings. Please let us know if we can be of any assistance.

We wish you all an enjoyable and interesting conference, and hope to see you all at the next meeting of the IACI!

Organizing committee

Prof. M Steyn (Forensic Anthropology Research Centre, Dept. of Anatomy, University of Pretoria)

Lieut-Col. M Pretorius (Criminal Record Centre and Crime Scene Management, South African Police Service)

Ms. N Briers (Dept. of Anatomy, University of Pretoria)

Brig. L Ras (Victim Identification Centre, South African Police Service)

Capt. TM Briers (Victim Identification Centre, South African Police Service)

Mr. M Loots (Dept. of Anatomy, University of Pretoria)

Ms. C Venter (Dept. of Anatomy, University of Pretoria)

Ms. Y Scholtz (Forensic Anthropology Research Centre, Dept. of Anatomy, University of Pretoria)

Ms. A Meyer (Forensic Anthropology Research Centre, Dept. of Anatomy, University of Pretoria)

Mr. WC Nienaber (Forensic Anthropology Research Centre, Dept. of Anatomy, University of Pretoria)

Message from the President of the IACI

I am thankful for this opportunity given to me to address this respectful public, novice students, devote academic members of this association and university representatives. I wish for all of us to share a pleasant experience of tranquillity for the restoration of this noble association, as we had some difficulties during the past year. Therefore, now we may take a breath and enjoy the conference together. All processes and activities go through important changes as part of the oscillation that have distinguished and marked the development of the science.

I am especially thankful for the untiring participation of Dr Wilkinson, who sets a standard for work and dedication; also my deepest respect to all the members of this South African organization, giving us the opportunity to meet again so that we can share the fruits of such important academic and technical scientific work.

Thanks a lot.

Dr. ER Gaytán.

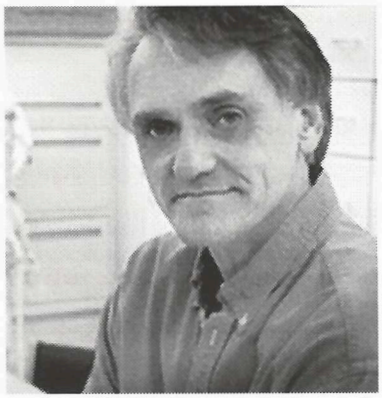
We are greatly indebted towards the following sponsors:

1. The Dean: Faculty of Health Sciences, UP
2. Campus Enterprises at the University of Pretoria (BE@UP and CE@UP)
3. Forensic Anthropology Research Centre (FARC)
4. Amarula
5. Forensics4Africa
6. Forensic Worx
7. Glenwood Travel

Workshop presenters

Ericka N L'Abbé's research is focused on both evaluating ancestry among South African groups and on blunt force injuries to bone. She is the only board certified forensic anthropologist in Southern Africa (D-ABFA, 84) and is also a certified scientific language editor. Ericka is employed by the Department of Anatomy (Forensic Anthropology Research Centre), University of Pretoria.

Marinda Pretorius has been the medical illustrator from the Department of Anatomy, Faculty of Health Sciences, University of Pretoria, South Africa since 1996. She received her Honours degree in BA (Communication) with Graphic Design in 1994 from the University of the North-West, RSA and is currently completing her Master's degree in Information Design at the University of Pretoria. The topic of her Masters dissertation is "An exploration of students' perceptions regarding medical illustrations as a learning tool". She has been responsible for numerous anatomical illustrations for research publications, study guides, conferences and front covers for books and CD-Roms. She also presents refreshment courses on all aspects of facial drawing for identification purposes for the South African Police Service.

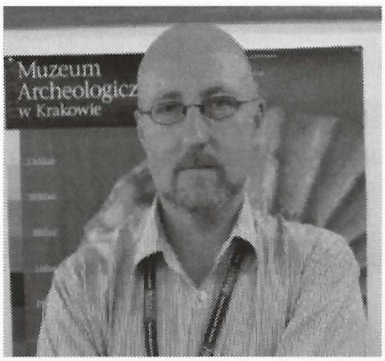


Prof SA Symes is an expert in interpreting bone trauma and is a leading authority on saw and knife mark analysis. He is a Board certified Forensic Anthropologists in North America (D-ABFA, 57) and is a sought-after consultant in criminal cases. He has lectured, consulted or testified on trauma cases, among them high-profile human rights cases, in the United States, Canada, Mexico, Peru, El Salvador, Indonesia, Kosovo, Europeand, most recently, South Africa. He works in the Department of Applied Forensic Sciences at Mercyhurst University and is an extraordinary professor in the Department of Anatomy.

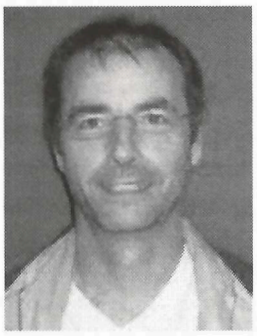
Dr. Elizaveta Valentinovna Veselovskaya (PhD) is head of the Laboratory of anthropological reconstruction of the Institute of Ethnology and Anthropology Russian Academy of Sciences, and associate professor of Russian State University for Humanities, Moscow. Elizaveta Veselovskaya was born in Moscow, a citizen of the Russian Federation. She graduated from the department of anthropology of the biological faculty of the Moscow State University. Since 1982, she has been working at this famous Gerasimov Laboratory under the guidance of Dr. Lebedinskaya, and then Dr. Balueva. She is an expert in the Russian method of craniofacial reconstruction. She published about 80 scientific, popular scientific, educational and methodical works. E. Veselovskaya gives lecture courses on physical anthropology, human evolution, and population genetics for the students of Russian State University for Humanities. E. Veselovskaya is the author of more than 50 sculptural and about 200 graphic portrait-reconstructions executed on skulls of historical figures, ancient inhabitants of Eurasia from Paleolithic to the present, and stages of Human Evolution.

Plenary lectures

Dr Sergio Damas is principal researcher at the European Centre for Soft Computing (ECSC), Spain. The ECSC is an R&D institution that is focused on the application of Artificial Intelligence to real-world problems. Among Sergio's research interests are computer vision, pattern recognition and medical imaging. Since 2005, he has been working on the automation of the craniofacial superimposition technique in order to assist the Forensic Anthropologist in the tedious and time-consuming task of finding the appropriate alignment between the skull and the face. In 2011, his team received two international awards for such an application. Sergio is also the coordinator of the EU project "New methodologies and protocols in forensic identification by craniofacial superimposition (MEPROCS)". Sergio is the founder and current chair of the IEEE Task Force on "Evolutionary Computer Vision and Image Processing". He is a member of the Advisory Committee in Computational Forensics of the International Association of Pattern Recognition. He is also a member of the Evolutionary Computation Technical Committee of the IEEE Computational Intelligence Society, EUSFLAT and SCIP working group.



Patrick Randolph-Quinney is based in the School of Anatomical Sciences, Wits Medical School. He holds a BSc in Archaeological Sciences and a PhD in Biological Anthropology. He originally started his academic life as an archaeologist specialising in the recovery and analysis of human skeletal remains, and has directed long-running excavations in South Africa investigating human evolution during the Middle Pleistocene. His research interests include the forensic quantification of hominin and modern human variation through the use of geometric morphometrics and shape statistics, the analysis and interpretation of skeletal trauma and pathology, and the study of cremains from a forensic and archaeological perspective. He is actively involved in forensic casework, and has acted as a consultant in the areas of forensic anthropology, forensic archaeology and body recovery.



Dr Chris Solomon graduated in theoretical physics from Durham University in 1983 and gained a PhD in medical image processing from the Institute of Cancer Research, London in 1989. From 1989 until 1993 he undertook post-doctoral research on wave propagation and imaging through atmospheric turbulence at the Blackett Laboratory, Imperial College before moving to Kent University where he is now a Reader in physics and leads the forensic image analysis group within the School of Physical Sciences. He has published more than 50 peer-reviewed research papers, written 4 book chapters and has successfully supervised 11 PhD students during his career. He spent 2009 at the National University of Ireland as the recipient of an EBS Walton Fellowship award. He is also author of the textbook "Fundamentals of Digital Image Processing – a practical approach", published in 2011. Dr Solomon has an outstanding record in technology innovation and the commercialization of University research. He was runner-up in the RCUK Business plan 2003 and the winner of both the UK and European stages of the European digital information contents competition DICON 2001.The recipient of two DTI SMART awards and a 2011 DTI Kellogg Management scholar, he is a regular consultant to UK police, delivering training to forensic police departments all over the world including the UK, USA, Canada, South Africa, Australia and Colombia. He is former Technical and now Managing Director of Visionmetric Ltd, the UK's leading developer of facial composite software and training.

Forensics artist Michael "Myke" Taister retired from the U.S. Federal Bureau of Investigation in 2007 after 31 years. In that time, Myke developed an expertise in demonstrative evidence such as skeletal reconstructions, composite drawings, shooting inquiries, and trial exhibits. He worked some of the biggest terrorism cases in the past two decades, including the 1993 attack on the World Trade Center, the 1996 Kobar Towers bombing in Saudi Arabia, the 1998 bombing of the U.S. Embassy in Kenya, and the 2000 attack on the USS Cole in Yemen. His work during the 1999 FBI mission to help investigate and catalog genocide in Kosovo earned special recognition from then-FBI Director Louis Freeh. Myke holds a U.S. patent for "ReFACE," a computer program designed to reconstruct facial images on unknown skulls for identification purposes.

31 years in FBI
artist
One of the early founders of the IAC1
and Lorted the

Col Ian van der Nest is based at the Victim Identification Centre, South African Police Service. Since

1998 he has presented training for new members of the Biology Unit of Forensic Science Laboratory in DNA techniques, as well as Crime Scene Investigations. He has also presented several lectures to the Justice Department, Pathologists, and various units in the South African Police Service. Col. Van der Nest has completed more than 1291 forensic examinations in disciplines which included DNA, Crime Scene Investigations, Crime Scene Reconstruction, Entomology and Exhumations and has given expert evidence in South African courts, as well as in Swaziland and Namibia. He has successfully testified in many High Profile cases, providing testimony in the afore-mentioned fields.

Caroline Wilkinson is Professor of Craniofacial Identification at the University of Dundee, Scotland. She carries out research in the area of Craniofacial identification, which deals with human variation, development and classification of faces and skulls. The focus of her research for the last 10 years has been to attempt to increase the accuracy of facial reconstruction methods by analysing the relationships between the soft and hard tissues of the face, in order to assess old and create new standards for practical use. This research has employed anthropometry, photogrammetry, clinical imaging, human dissection, surface scanning, face pool identification, volunteer resemblance assessments, skeletal assessment and automated statistical models. Previous research has also included the analysis of juvenile facial tissues using ultrasound measurements, cranial growth in adults, skull reassembly, the use of facial reconstruction in Egyptology and archaeology and juvenile facial reconstruction. She is a Past-President of the IACI and is on the Steering Committee of BAFA. Caroline has been involved in human identification research from CCTV images and has acted as an expert witness in facial image analysis for Criminal Court. She is an associate member of the Facial Identification Scientific Working Group (FISWG) and carries out training courses in facial image comparison.

Symposium

Evidence-based techniques for police investigators to improve eyewitness memory, facial composite construction, and facial recognition

When a crime is committed, the police rely on the help of eyewitnesses to help them find the perpetrator. Therefore, it is important to identify police techniques that can help witnesses remember more about the crime and the perpetrator. These techniques can further the police investigation by facilitating witnesses' ability to construct a facial composite (with the goal of finding a suspect), and by helping witnesses to identify the perpetrator. This symposium brings together laboratory- and field-based research on facial composites and facial recognition in eyewitness settings. Paper 1 presents a novel software system capable of creating life-like synthetic faces that can provide similarity-controlled foils for police line-ups. Paper 2 presents two laboratory experiments investigating whether instructing the witness to close the eyes during the investigative interview—a method shown to improve memory for events—can also improve facial recognition and line-up identification performance. Paper 3 presents the findings from a field study exploring the eye-closure instruction in real-life witness interviews conducted by the South African Police Services (SAPS)—specifically, how eye-closure during the interview affects subsequent construction of facial composites. Paper 4 explores the effectiveness of different facial composite construction methods in controlled laboratory settings. Paper 5 presents a meta-analysis (an "analysis of analyses") examining whether the construction of facial composites contaminates or facilitates subsequent facial recognition. Finally, Paper 6 applies laboratory techniques to the case study of the "Station Strangler", examining the facial composites and the line-up featuring in the case. Taken together, the findings should provide insight into facial composite construction and facial recognition processes.

Symposium presentations

	Title	Presented by
Paper 1	Synthetic faces for eyewitnesses and face recognition: Research and practice.	Prof CG Tredoux
Paper 2	Closing the eyes during witness interviews: Effects on subsequent facial recognition performance	Dr A Vredevelt, Prof CG Tredoux, Ms A Nortje, Ms K Kempen
Paper 3	Analysis of current composite construction techniques in the SAPS: Does an initial eye-closure interview facilitate composite construction?	Ms K Kempen, Dr A Vredeveldt, Prof CG Tredoux, Ms A Nortje, Ms C Puljević
Paper 4	The effects of assisted and single-operator composite construction on recognition and composite quality: Are two heads better than one?	Ms K Kempen, Prof CG Tredoux, Dr A Vredeveldt
Paper 5	Do facial composites contaminate memory? A meta-analysis.	Dr A Vredeveldt, Prof CG Tredoux, Prof SL Sporer, Ms K Kempen, Ms A Nortje
Paper 6	Investigating the Station Strangler case: Applying laboratory techniques to a real-life case.	Ms A Nortje, Prof CG Tredoux, Ms K Kempen, Dr A Vredeveldt

Programme at a glance

3 Aug 2013

Arrival. No formal activities. Delegates to provide own dinner from restaurant or cafeteria.

Registration and keys to rooms: 14:00 – 17:00 (Conference Centre)

4 Aug 2013

07:00 – 09:00	Breakfast (Restaurant)
07:30 – 08:30	Registration (Conference Centre)
08:30 – 10:30	(two workshops to run simultaneously)
Workshop 1	Facial Reconstruction (Breakaway Room 1)
Workshop 2	Craniometric variation (Breakaway Room 2)
10:30 – 11:00	TEA (Conference Centre)
11:00 – 13:00	(two workshops to run simultaneously)
Workshop 3	Photoshop Session 1 (Breakaway Room 1)
Workshop 4	Blunt force trauma (Breakaway Room 2)
13:00 – 14:00	LUNCH (Restaurant Deck)
14:00	Welcoming (Dean Faculty of Health Sciences, University of Pretoria) (Conference Hall)
14:15	Official opening (Head: Forensic Science Laboratory)
14:30	Message from the President of the IACI
14:40	Introduction of Plenary Speaker
14:45	Plenary lecture 1
15:30	TEA (Conference Centre)
16:00	Past presidents meeting (Breakaway Room 2)
	Photoshop workshop session 2 (optional, Breakaway Room 1)
18:00	Welcoming cocktail (Deck at Conference Centre)

5 Aug 2013

07:00 – 09:00	Breakfast (Restaurant)
08:00	Registration (Conference Centre)
08:30	Welcoming and announcements
08:45	Plenary lecture 2

09:30	Academic session 1
10:30	TEA (Conference Centre)
11:00	Academic session 2
12:45	Conference photo (Parking area)
13:00	LUNCH (Restaurant Deck)
14:00	Plenary lecture 3
14:45	Academic session 3
15:30	TEA (Conference Centre)
17:00	Depart for Bush Braai: meet at parking in front of Conference Centre – arrive at bushbraai site 19:00

6 Aug 2013

07:00 – 09:00	Breakfast (Restaurant)
08:30	Plenary lecture 4 (Conference Centre)
09:15	Academic session 4
10:30	TEA (Conference Centre)
11:00	Academic session 5: Symposium
13:00	LUNCH (Restaurant Deck)
14:00	Plenary lecture 5
14:45	Academic session 6
15:30	TEA (Conference Centre)
16:00	Poster session and demonstration of 3D printing
19:00	Conference dinner (Restaurant Boma)

7 Aug 2013

07:00 – 09:00	Breakfast (Restaurant)
08:30	Plenary lecture 6 (Conference Centre)
09:15	Academic session 7
10:00	TEA (Conference Centre)
10:30	Bi-annual General Meeting
12:00	Lunch (Restaurant Deck) and Departure

Scientific Programme

4 Aug 2013

07:30 – 08:30	Registration
08:30 – 10:30	(two workshops to run simultaneously)
Workshop 1	Facial Reconstruction: Achievements of the Russian school of craniofacial reconstruction in the field of Forensic Medicine
	Presented by Dr E Veselovskaya
Workshop 2	Craniometric variation among 20th century black, white and coloured South Africans
	Presented by Prof Ericka N L'Abbé, with Michael W Kenyhercz and Kyra E Stull
10:30 – 11:00	TEA
11:00 – 13:00	(two workshops to run simultaneously)
Workshop 3	Photoshop skills for post-mortem facial depiction (session 1)
	Presented by Mrs M Pretorius
Workshop 4	Craniofacial blunt force trauma
	Presented by Prof Steven A Symes
13:00 – 14:00	LUNCH
14:00	Welcoming
	Prof E Buch, Dean Faculty of Health Sciences, University of Pretoria
14:15	Official opening
	Major General EK Ngokha: Head: Forensic Science Laboratory (SAPS)
14:30	Message from the President of the IACI
	Dr ER Gaytán
14:40	Introduction of Plenary Speaker: Prof MC Bosman, Head Dept. of Anatomy
14:45	Plenary lecture 1: The role of physical anthropology in criminal forensic investigation in South Africa
	Col I van der Nest
15:30	TEA
16:00	Past presidents meeting
	Photoshop workshop session 2 (optional)
18:00	Welcoming cocktail

5 Aug 2013

08:30	Welcoming and announcements (M Steyn)
08:45	Facial identification and facial reconstruction. Chairperson: Dr M Taister
	Plenary lecture 2: Faces and identification - the image is everything
	Prof C Wilkinson
09:30	Automated facial recognition of craniofacial reconstruction models
	C Rynn, C Wilkinson
09:45	Validation of a computational framework for CT-based craniofacial reconstruction
	D Vandermeulen, P Claes, B De Dobbelaer, G Willems, S De Greef, W De Velter, W Van De Voorde, F Tilotta, Y Rozenholc, Á Kustár, P Suetens
10:00	Facial fatness as a complicating factor in forensic facial reconstruction (preliminary results)
	CA Clarke, AG Morris, LJ Friedling
10:15	Facial soft tissue thickness differences among three skeletal classes in Japanese population
	H Utsuno, T Kageyama, K Uchida, K Kibayashi
10:30	TEA
11:00	Facial identification and facial reconstruction (ctd) Chairperson: Dr C Rynn
	The cross-race effect on forensic facial reconstruction and recognition
	WJ Lee
11:15	Cranio-facial reconstruction of St Laszlo the Hungarian King from the 11th century.
	Á Kustár, K Vollmuth, A Balikó, I Pap, GY Pálfi, E Molnár, I Kozma, P Claes, D Vandermeulen
11:30	The face of the past: An assessment of the reliability of the Manchester Method of craniofacial reconstruction through confirmation of the underlying bone structure on reconstructed faces.
	DA Finaughty, J Hemingway, B Speed, AG Morris
11:45	Facial mapping: Anthropometric techniques tested
	SS Sharp
12:00	Facial identification successes in South Africa
	F Marimuthu
12:15	Understanding decomposition in facial reconstruction
	J Myburgh

12:30	Conference photo
13:00	LUNCH
14:00	Craniofacial Superimposition. Chairperson: Prof D Vandermeulen
	Plenary lecture 3: New horizons in craniofacial superimposition: technical advances applying Soft Computing – Computer Vision and EU standardization efforts
	Dr S Damas
14:45	Skull-photo superimposition: what can the expert witness say?
	G Gordon, M Steyn
15:00	Craniofacial superimposition: Accuracy study
	C Wilkinson, A Tillotson
15:30	TEA
16:00	Depart for Bush Braai

6 Aug 2013

08:30	Faces: composites, growth and shape. Chairperson: Lt-Col. M Pretorius
	Plenary lecture 4: Advances in identification using facial composites
	Dr C Solomon
09:15	Juvenile age estimation from facial images
	EL Ferguson, CM Wilkinson
09:30	Geometric morphometric assessment of facial shape in twins: a case study
	TM Briers, M Pretorius
09:45	Assessment of lateral facial shape change in South African pre-pubescent children
	N Briers, M Steyn, TM Briers
10:00	A morphometric analysis of the paranasal air sinuses within a South African population from childhood to adulthood
	CO Rennie, MR Haffajee, KS Satyapal
10:15	Assessing the effects of tooth loss in adult crania using geometric morphometrics
	C Small, D Brits, J Hemingway
10:30	TEA
11:00	Symposium: Evidence-based techniques for police investigators to improve eyewitness memory, facial composite construction, and facial recognition Chairperson: Dr A Vredeveldt, and Prof J Vellema

11:00	Synthetic faces for eyewitnesses and face recognition: Research and practice. CG Tredoux
11:20	Closing the eyes during witness interviews: Effects on subsequent facial recognition performance A Vredeveldt, CG Tredoux, A Nortje, K Kempen
11:40	Analysis of current composite construction techniques in the SAPS: Does an initial eye-closure interview facilitate composite construction? K Kempen, A Vredeveldt, CG Tredoux, A Nortje, C Puljević
12:00	The effects of assisted and single-operator composite construction on recognition and composite quality: Are two heads better than one? K Kempen, CG Tredoux, A Vredeveldt
12:20	Do facial composites contaminate memory? A meta-analysis. A Vredeveldt, CG Tredoux, SL Sporer, K Kempen, A Nortje
12:40	Investigating the Station Strangler case: Applying laboratory techniques to a real-life case. A Nortje, CG Tredoux, K Kempen, A Vredeveldt
12:50	Discussion and closure
13:00	LUNCH
14:00	Miscellaneous topics. Chairperson: Mrs. N Briers Plenary lecture: Out of Africa: Functional and evolutionary constraints on modern human facial morphology Dr P Randolph-Quinney
14:45	Changes in emotional bonds between deceased and kinsfolk in situations of disaster: February 27th 2010 - Chili. The invisible emergency ER Gaytán
15:00	Skeletal changes to the cranium after post-mortem exposure to fire as an indicator of decomposition stage N Keough, EN L'Abbé, M Steyn, S Pretorius
15:15	My year training with the world trade center DNA identification unit at the New York city office of the chief medical examiner LZ Rossouw
15:30	TEA
16:00	Poster session Chairperson: Prof M Steyn

	Demonstration of 3-D scanning and printing: Capt TM Briers (SAPS)
19:00	Conference dinner

7 Aug 2013

08:30	Miscellaneous topics Chairperson: Capt TM Briers
	Plenary lecture: 30 Years with the FBI.
	Dr M Taister
09:15	A reassessment of hyoid fractures
	EN L'Abbé
09:30	Case report: unusual cranial surgical trauma
	M Steyn
10:00	TEA
10:30	Annual general meeting and Closure
12:00	Departure

ORAL PRESENTATIONS

Assessment of lateral facial shape change in South African pre-pubescent children.

N BRIERS,[1] M STEYN,[1] TM BRIERS.[2] [1]Forensic Anthropology Research Centre, Department of Anatomy, University of Pretoria, South Africa, [2]Forensic Anthropology Section, Forensic Sciences Laboratory, South African Police Services. nbriers@up.ac.za

Facial growth during puberty causes changes in the craniofacial complex. Understanding related shape changes at different ages is essential for accurate aging of long-term missing children and the comparison of the facial profile of young individuals to a photograph that may have been taken around puberty. The aims of this study were firstly to determine differences of the mean shape per age group and secondly, to determine how the mean shape of boys and girls differ from each other. Thirdly, differences in the mean shape of children from different geographical regions were analyzed. Lateral facial photographs of 800 boys and girls, aged 6-13 years, from different geographical locations, namely Gauteng (n = 400) and the Western Cape (n = 400), were taken in the Frankfurt plane. Geometric morphometrics were used to determine the mean lateral facial shape of each group per age, sex and geographical location. The relative warp analysis showed differences between the 6 - 8-year old group and the older age groups. The 9 – 11-year old groups clustered together between the younger and older age groups. The CVA and TwoGroup analyses showed significant differences between the children from different geographical regions regardless of age. The same analyses per sex showed only significant differences at the 8-year old and 13-year old age groups. As a result, it was possible to correctly assign 80% of boys and 86% of children from different geographical regions (regardless of age and sex) based on the geometric morphometric analysis of their lateral facial profile. In contrast, only 20% of girls could be correctly assigned. These results suggest that differences in the lateral profiles in terms of sex are significant at age 9 and age 11. This correlates with our previous study based on facial indices, where marked differences were seen at similar ages.

Geometric morphometric assessment of facial shape in twins: A case study

TM BRIERS, M PRETORIUS. Forensic Anthropology Section, Forensic Sciences Laboratory, South African Police Services. BriersTM@saps.gov.za

Distinguishing between twins in a forensic context presents a challenge to forensic facial analysts. It is often required that comparisons be performed on images with different illumination levels and the head at different angles as photographs of criminals are rarely taken under ideal laboratory conditions. The aim of this study was to determine whether geometric morphometrics is a useful tool to distinguish between facial photographs of identical twins which were taken under various conditions. The sample consisted of one clear anterior facial photograph of each twin (labelled twin A and twin B) and a pool of four other facial photographs of the twins with various lightning conditions, and slightly different head inclinations. This was a double blind study and the comparison was performed by someone who had knowledge of geometric morphometrics, but who was not familiar with the twins. Firstly, 12 landmarks representing the facial shape on all photographs was digitized using TPSDig. Secondly, TPSrel and TPSspline were used to determine the facial shape of each twin and then twin A and B were compared to the unknown pool. The relative warp analysis showed differences between the twin A and B. Two of the four unknown photographs clustered together with twin B, while only one unknown photograph showed association with the photograph of twin A. The PCA and TwoGroup analyses showed that it was possible to correctly assign 3 (75%) of the images based on geometric morphometric analysis, while one photograph could not be correctly assigned. These results suggest that differences with regards to facial features, even between twins, can be detected despite the fact that circumstances may be less than ideal. Although this is only one example, it is envisaged that we will test the method on more real-life cases in order to test the robusticity of scientific methods.

Facial fatness as a complicating factor in forensic facial reconstruction (preliminary results).

CA CLARKE, AG MORRIS, LJ FRIEDLING. Department of Human Biology, Faculty of Health Sciences, University of Cape Town. clrcar008@uct.ac.za

Although it is a reasonable assumption that a significant proportion of the variation in facial tissue thicknesses comes from anatomical differences between populations, we do not know how much of normal variation is caused by including the full range of individual obesity or slimness. Current population standard soft tissue thickness data used in facial reconstructions ignores the variation between individuals which, in theory, could be greater than the variation between populations or sexes. The aim of this study is to test if facial tissue thickness is due to the amount of sub-cutaneous fat, sex or racial origins. One of the objectives is to help develop more consistent methods for facial reconstruction in forensic cases by giving us critical information that will help us understand how variation in soft-tissue thickness affects the accuracy of these reconstructions. Methods currently used do not give a true reflection of the individual because they ignore the variation in fatness. The study has two stages. The x-ray stage will determine a corrective value for the non-linear distortion found between images and the actual physical tissues. This is being done by imaging cadaver heads and taking measurements from the images and the physical heads. Once data is gathered it will be statistically analyzed to determine the difference between physical measurements and x-ray image measurements. This presentation will discuss the preliminary results obtained at the time.

Juvenile age estimation from facial images.

EL FERGUSON, CM WILKINSON. Centre for Anatomy and Human Identification, College of Life Sciences, University of Dundee, Dow Street, Dundee, Scotland, DD1 5EH.
e.l.ferguson@dundee.ac.uk

Age determination from images can be of vital importance, particularly in cases involving child sexual exploitation (CSE). It is imperative to determine if an individual is indeed a juvenile, with a more concise age often sought, as this may affect the severity of offender sentencing. Age evaluations may also be used to aid in the sequencing of images, when there are several images present which have been taken over a period of time. This research will examine the accuracy of age estimation from facial images, focussing on the specific age spectrum of my research, 0-15 years. Error margins of a single age estimate will be analysed in relation to the pre-defined age cohorts of 0-5, 6-10, and 11-15 years. Consideration will be given to the use of age determination from facial images in court proceedings in relation to the admissibility of expert evidence.

The face of the past: An assessment of the reliability of the Manchester Method of craniofacial reconstruction through confirmation of the underlying bone structure on reconstructed faces.

DA FINAUGHTY,[1] J HEMINGWAY,[2] B SPEED,[1] AG MORRIS.[1]
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There has been much debate about the accuracy and reliability of craniofacial reconstruction methods. It has been argued that three-dimensional manual reconstruction is prone to poor reliability due to the assumed high incidence of artistic deviation from the repeatable scientific methodology as a function of artistic interpretation of the remains. No consensus has been reached in the literature regarding the extent to which artistic deviation influences reliability. The aim of the present study is to develop a method to determine whether or not artistic deviation is a significant factor in five reconstructions using the Manchester Method. Three-dimensional digital dot matrix maps of craniofacial biometric landmarks representing the cranial and reconstruction profiles for each specimen were created using a MicroScribe®. The cranial and reconstruction profiles were superimposed for each specimen utilising two geometric morphometric methods developed for the present study with a view to quantifying reconstructed tissue depth and comparing it to standard facial tissue thickness values. Principal Components Analysis was also conducted to enable analysis of morphological change. Results of the analysis of quantified reconstructed tissue thickness and morphological change revealed strong evidence of artistic deviation (average of 1.81mm excess reconstructed tissue across all landmarks and specimens, visually verified in the PCA Plots). It is argued that, although this does indeed impact the reliability of the reconstruction method, it does not diminish the more important-scientific validity of the method as currently used.

Changes in emotional bonds between deceased and kinsfolk in situations of disaster: February 27th 2010 – Chile. The invisible emergency.

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In this particular paper events which happened in Penco parochial Cemetery related to the crumbling of a wall containing graves during the mega earthquake of February 27th 2010 in Chile from a forensic anthropological intervention perspective are discussed. The relevance of the lack of integral assistance with a social and cultural perspective and the corresponding consequences of the earthquake are highlighted. Thus, emotional implications, identity and affection consequences which derive from the loss of bond among kinsfolk and their corresponding deceased when cemeteries are significantly damaged with no inmediate adequate response are analyzed. Forensic Anthropology as integral discipline shows outstanding advances in its interventions related to disasters. However an adjoining and coordinate kind of work in association with other areas and various institutions based on updated protocols that can lead the way in the emergent complexity of social phenomena which happen during the different stages of a disaster is required.

Skull-photo superimposition: what can the expert witness say?

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Forensic scientific research aims to improve techniques and develop methodologies and one such aim is to determine the identities of victims of crime. At times there may be a potential identity for a victim of crime and then ante-mortem photographs of the victim could be used to establish the identity through skull-photo superimposition. Techniques and methodologies such as skull-photo superimposition are very important when employed in a court of law as legal evidence. The aim of this study was to evaluate the accuracy of a digital photographic superimposition technique and to establish differences between the South African and American legal systems. Forty facial photographs were selected and for each photo, 10 skulls (including the skull corresponding to the photo) were used for superimposition. The superimposition was carried out in 3D Studio Max, involving a morphological superimposition as well as using selected anatomical landmarks. A total of 800 skull-photo superimpositions were carried out using both methods. In 85% of cases the correct skull was included in the possible matches for a particular photo using morphological assessment. However, in all cases between zero and three other skulls could also match a specific photo. In the landmark based assessment, the correct skull was included in 80% of cases. Once again, however, between one and seven other skulls also matched the photo. When using the morphological and landmark assessments combined, 97.5% of correct skulls were included in the list of possibilities, but between one and seven false positives per case were found. Although several shortcomings exist such as the fact that only single images of cadavers in a supine position were used, it seems that a positive identification can not be made based on a single superimposition. Using current knowledge, it is proposed that identifications made with single images do not meet Daubert standards, and may also not stand up in a South African court of law.

Analysis of current composite construction techniques in the SAPS: Does an initial eye-closure interview facilitate composite construction?

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Laboratory research shows that eye-closure during memory retrieval can improve recall of a witnessed event. We examined whether the effectiveness of eye-closure would extend to a field setting. Twelve interviewers from the Facial Identification Unit of the SAPS were recruited. Half of the interviewers were trained in using the eye-closure technique in their interviews with witnesses; the other half were not trained (control condition). This talk focuses on the effect of the eye-closure technique on subsequent facial composite construction (identi-kits). Previous research shows that composites often do not resemble the perpetrator. We investigated whether eye-closure during the interview affects the quality of subsequent facial composite construction. We compared witnesses in the control and eyes-closed condition in terms of ratings of confidence of facial feature selection, best remembered features, and composite resemblance to the witness's memory. Findings and implications will be discussed.

The effects of assisted and single-operator composite construction on recognition and composite quality: Are two heads better than one?

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Research conducted on the effects of composite construction on recognition has been equivocal, with some research finding composite construction to have a facilitating effect on memory for the original target, other research finding no effect on memory, and further research finding a detrimental effect on memory. There is a disparity between laboratory research and practice. Laboratory studies typically have a single-operator witness. In forensic settings, witnesses do not construct composites themselves; the police operator constructs a composite for them, based on their instructions. This experiment compared the recognition rates, and composite quality, between single-operator laboratory procedures, and a paired describer and operator. The results of the study and the implications for law enforcement will be discussed.

Skeletal changes to the cranium after post-mortem exposure to fire as an indicator of decomposition stage.

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Discovery of burnt bone often evokes questions as to the condition of the body prior to a burn event. The purpose of this study was to score features attributed to thermal damage on the cranium as a means to evaluate burn damage with both condition of bone (dry or wet) and with the progression of decomposition. Twenty five pigs in various decomposition stages were exposed to fire for 30 minutes and the cranial elements scored. Scored features included colour change (unaltered, charred, calcined), brown and heat borders, heat lines, delineation, greasy bone, joint shielding, predictable and minimal cracking, delamination and heat-induced fractures. Colour changes were scored using a ranked scale (0 – 3) and the remaining traits as absent or present (0/1). Density plots and frequency distributions were constructed and multiple regression and transition analysis were conducted to gain both descriptive and predictive insights into the relationship between heat-related alterations to the cranium and the stages of decomposition. Of the 13 traits scored, eight displayed potential to predict decomposition stage from burned remains. Increasing calcined and charred bone occurred synchronously with advancement of decomposition, with subsequent decrease in unaltered surfaces. Greasy bone appeared more often in the early/fresh stages (fleshed bone). Heat borders are associated with advanced decomposition; bone lacks tissue but is still wet. The presence of brown burn/borders, delamination and other heat-induced fractures are associated with late skeletonization (dry bone) showing that the organic composition of bone and the percentage of flesh present affect the manner in which it burns. In conclusion and based on the data analysis, heat-induced changes may assist in estimating decomposition stage from unknown, burnt remains thereby aiding in the estimation of a postmortem interval.

Cranio-facial reconstruction of St Laszlo the Hungarian King from the 11th century.

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King László I. (1046–1095) of Hungary was very famous throughout Europe in the Middle Ages. After his canonization (in 1192) his tomb was opened and his head was placed into a reliquary (herm). The original herm was destroyed by a conflagration, yet the skull remained preserved. The present herm was made during the XVth century and has been kept in the Our-Lady-Cathedral in Győr to date. Although the Holy King was immortalized by several preserved frescos in medieval Hungarian churches, we lack any authentic portrait from during his lifetime. The first aim of our study was to prove the originality of the skull relic assigned to King László I. by physical anthropological methods. The second aim was to revive the authentic feature of the king's face using craniofacial reconstruction, while estimating the missing mandible needed for this reconstruction. The final aim was to evaluate the similarity of the resulting reconstruction to the herm. In order to estimate the missing mandible, a reference database of 3D CT images of Western-Caucasian (N=102) complete and contemporaneous Hungarian (N=12) nearly complete skulls was used. These images were first segmented into skeletal tissue, landmarked using a fully automatic spatially-dense landmarking procedure and geometrically superimposed using Procrustes alignment, resulting in an average skull shape and linear modes of statistical shape (co-)variation. Estimation of the missing mandible was obtained by fitting this complete statistical model to the partial skull. The fitting changes the average skull shape to the given partial skull shape, whilst simultaneously detecting and estimating missing parts using the co-variation present in the model. This procedure was validated using leave-one-out cross-validation on the two ancestral subsets, separately and combined. A traditional sculpting method for craniofacial reconstruction was applied to a 3D copy of the skull. Finally, similarity to the herm was tested using 3D surface registration methods. The anthropological investigation confirmed the originality of the skull-relic. The first attempt of the mandible reconstruction, based on the strictly western-caucasian ancestry database, resulted in a high and long mandible shape with a prominent chin. Inclusion of a small number of contemporaneous skulls resulted in a shorter mandible with slightly retrognathic chin. The craniofacial reconstruction was fairly different from the herm. This can be partly explained by the fact that the present herm was made 400 years after the king's death, so the goldsmith master could not have had any thorough knowledge of the King's face.

Hyoid fractures in cases of fatal blunt force injuries to the neck and upper body

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Literature on hyoid fractures with various mechanisms of death is contradictory and does not provide a systematic approach to assessment and interpretation of bone fractures. The purpose of this study is to assess the relationship of hyoid fractures with mechanisms of injury, sex, age, fusion, and soft tissue haemorrhage. A total of 276 (209 males, mean age 36; 56 females, mean age 38) from motor vehicle accidents (MVA), pedestrian vehicle accidents (PVA), falls, strangulations and hangings were examined from September 2009 to June 2011 at Forensic Pathology Services: Johannesburg. Neck structures were dissected using the Gordon-Prinsloo method. Haemorrhage was recorded. Logistic regression tested the probability of fracture with these variables. Fractures occurred 24% on the greater horns, at the articular facets, and on the body, and associated with 2 strangulations; 8 falls; 14 PVAs; 20 MVAs and 23 hangings. Mechanism of injury, sex and haemorrhage did not increase the probability of fracture. Persons 50 years or older had a 4.3 increased likelihood of fracture. Unilateral fusion of the greater horn was 2.9 (right) and 2.7 (left) times more likely to fracture than unfused or completely fused bones. The configuration of a unilaterally fused hyoid, bone histology, and composition of muscle and cartilage may contribute more to a fracture than mechanism of injury or sex. Circumstances for a fracture are likely biomechanical in nature: magnitude, direction, duration, and location of force. Recognition, examination and interpretation of skeletal trauma are invaluable tools that can provide information as to cause and manner of death.

The cross-race effect on forensic facial reconstruction and recognition.

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Previous research into the reliability of forensic facial reconstruction has focused mainly on the accuracy of reconstructed faces from European or African ancestry skulls. Moreover, the recognition of facial reconstructions in relation to the biological identity of the practitioners or assessors has not been previously considered. The cross race effect is a recognised phenomenon in psychology studies, where same race faces are recognised more readily than other race faces, but there is a paucity of research addressing the relationship between the accuracy of reconstructed faces and the race of the practitioners/assessors. The aims of this research were to investigate whether the cross-race effect has any influence on the accuracy of facial reconstruction using both experienced and trained practitioners and to evaluate how much the correct recognition rate of facial reconstruction is affected by the cross-race effect. Fifteen facial reconstructions from three ancestry groups were produced by experienced and trained practitioners in order to explore the aims. The results demonstrated that practitioners produced more recognisable reconstructions using skulls from their own race than skulls from other races, but that training and experience in recognising and reconstructing other race faces will reduce this cross-race effect.

Facial identification successes in the South African

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The Facial Identification Section was founded in 1975 by the South African criminal bureau. During this time, the section was not seen as an independent functionary body, but as a special service attached to the Wanted and Missing Persons Bureau. In the 1990's, the need for facial identification technology became apparent. Comphotofit Plus 2 was selected as the product to be used by the bureau. The product was manufactured by Sirchie Products and South Africa was introduced into the age of computers. In 1994, 12 laptops were purchased and official training began. During 1996, the American arms company, Smith and Wesson, produced a handset similar to the Sirchie fit system. Smith and Wesson produced a computer version of the handset Idkit 2000 in 1998, and this version was used by the South African police to produce facial composites together with graphic art software called Adobe Photoshop. In 2009 the South African Police Service was able to procure 10 Licenses for E-FIT software and in March 2010 official training began countrywide. This software is currently still widely in use and has been successfully used in the build up to the investigation and apprehension of suspects in various cases. The aim of this study is to present several case studies in order to show the practical application of software programs such as Idkit 2000 and EFIT, and to illustrate how these programmes contributed to the success of the investigations. In conclusion, the study shows the need for companies to update, improve and develop new programmes in order to keep this important function being utilized by law enforcement agencies.

Understanding decomposition in facial reconstruction.

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Facial reconstruction often relies on information from the biological profile such as ancestry, age and sex to make an accurate estimation of the individual features. However, in cases involving remains in advanced stages of decomposition additional features that may be of help may still be present. These include shape of the eyes and nose, the present or absence of facial hair as well as any possible lesions on the skin. Care should be taken when making use of these features and the processes that influence them should be understood. The aim of this presentation is to discuss the various processes that occur during decomposition and apply them to the various facial features. Autolysis of cells may cause misinterpretation of ancestry (due to discolouration), age (skin slippage) and the general appearance of the face (edema of the face, eyelids and lips). Mummification of features, on the other hand, can aid in the reconstruction by giving a clear indication of the morphology of certain structures, such as the nose. Retention of the hair which may be an indicator of ancestry, age and sex of the individual can also be helpful, although they may have been modified. Examples of cases received by the FARC, University of Pretoria, will be used to demonstrate some of these issues.

Investigating the Station Strangler case: Applying laboratory techniques to a real-life case.

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This research aimed to apply laboratory methods and procedures to assess the line-up and the composite created in the Station Strangler case. The goal was to determine whether the line-up was 'fair' (as defined in eyewitness research) and whether the composite was a good likeness to Norman Simons. Participants were shown a video-clip of the actual line-up and had to indicate whether Simons was present. In a second experiment, participants had to compare randomly-selected faces to the composite made of Simons, and had to indicate which faces were viable physical matches. While Simons was not chosen most frequently, he was chosen above chance levels. These results and the possible conclusions are discussed.

A morphometric analysis of the paranasal air sinuses within a South African population from childhood to adulthood.

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It is widely accepted that the craniofacial complex, in particular the nasal region, exhibits the most variation. Forensic experts rely on techniques relating to the external cranium when identifying a cranium of unknown origin. Limited studies have focused on the internal nasal complex specifically the paranasal air sinuses (PAS) and even fewer within the South African context. To this extent, this study provides an alternative methodology of analyzing the cranium utilizing radiographic techniques. Therefore, the aim of this study was to assess the morphometry of the PAS within a South African population using the latest Multidetector Computed Tomographical (MDCT) imaging system. This was a retrospective review of MDCT scans of 112 patients obtained from King Edward Hospital, within the eThekweni area. Excluding sinus pathology and maxillofacial injury, a final sample of n=50 patients (28 males, 22 females) with an average age of 23.2 was selected. The selected scans were then reprocessed using 3D Slicer open-source medical imaging software, in order to reconstruct a 3D model of each PAS. A total of n=200, three dimensional models was reconstructed from which the subsequent cumulative volumes was calculated. The mean volumes of the bilateral sinuses were 27.35 cm^3, 8.90 cm^3, 14.91 cm^3 and 10.13 cm^3 for the maxillary, frontal, ethmoidal and sphenoidal air sinuses respectively. The maxillary air sinus volume reached its maximum between 31 to 40 years of age, whilst all other air sinuses reached maximum growth between 21 to 30 years of age. Comparison of the male and female PAS, revealed that the parameters for the females were larger. Aplasia of the PAS was found in 12% of the sample. Data revealed that population differences exists and reflects different growth patterns and shape morphology within this population group which may be useful forensically. This study revealed a possible method of analysing the PAS. However, further study is necessary to elaborate on the value of this technique in forensic identification.

My year training with the world trade center DNA identification unit at the New York city office of the chief medical examiner

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The World Trade Center (WTC) attack on September 11 2001 resulted in the largest and most complex crime scene in U.S. history to date. This event not only changed the way the world views mass fatality incidents but the aftermath of those attacks has spawn a new era of technology development in a quest to identify the victims of 9/11. With approximately 21 000 individual sets of human remains recovered from the scene, the WTC disaster represents one of the most comprehensive victim identification efforts undertaken to date. The New York City Office of the Chief Medical Examiner was confronted with severely compromised remains. Recovered human remains were found to have sustained massive fragmentation and degradation owing to the impact of the airliners and subsequent collapse of all seven WTC buildings, making DNA typing difficult. Efforts to identify the remains involve using new technology refined from a decade ago. However, most of the DNA profiles generated currently belongs to previously identified victims. Of the 21 00 remains recovered, nearly 9 000 are unidentifiable due to their degraded condition. This leaves more than 1 100 victims with no identifiable remains. While at the Forensic Biology Laboratory of the OCME, I trained with the WTC DNA Identification Unit on the optimized WTC bone (or tooth) processing protocol for compromised remains. The protocol includes refined methods in pre-cleaning the sample with tergazyme, decontamination through sonication, demineralization extraction, automated extraction and ultra-purification, microconing PCR product and capillary electrophoresis using mini-filer. Training also involved STR data interpretation and CODIS for matching victim profiles with known reference samples.

Automated facial recognition of craniofacial reconstruction models.

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This research aimed to address the problem of identifying skulls in a mass fatality incident (MFI) where dental / DNA matching is impossible. The objective was to adapt or produce a facial recognition system which would 'recognise' a forensic craniofacial reconstruction (CFR) and 'match' it to a passport-style photograph, on the assumption that such images may be contained in a missing persons' database (e.g. Interpol MPUB). This study utilised adult male CT data and accompanying facial photographs from the University of Tennessee.
Existing commercial facial recognition systems were tested before an *ad hoc* system was produced. The system was tested using facial photographs; accurate 3D models of faces (CT and laser scans); 5 CFRs of known targets; then 5 CFRs of unknown targets.
Results indicate that it is possible to narrow the field of inquiry by automatically ranking a database of frontal facial photographs in order of similarity in shape to a CFR model; then carrying out subsequent craniofacial superimposition on the top 20% of the database to further narrow the search.

(Part of the FastID project, in collaboration with Interpol, Fraunhofer Institute, Plassdata, BKA)

Facial mapping: Anthropometric technique tested

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Facial mapping is a corroborative tool in facial comparisons although the angle limits the effectiveness of the facial comparison. The aim of the study was to perform measurements on an individual photographed at different angles and then the same measurements on two different individuals from the same angle in order to determine the magnitude of the differences in measurements. Parallel lines were drawn from the left hand image to the right hand image by the following method: a) trichion on the left hand image across to the right hand image; b) peak of the right eyebrow on the left hand image across to the right hand image; c) exocanthion of the right eye on the image on the left across to the right hand image; d) nasal tip of the image on the left across to the right hand image; e) stomion of the image on the left across to the right hand image; f) gnathion of the image on the left across to the right hand image. Subsequently the following measurements were taken: a) the nose length as measured from the midnasal point to the nasal tip; b) the medial vermillion height of the lower lip; c) the length fo the cutaneous area between subnasale and labiale superious; d) the length from the stomion to the gnation. The same process was followed with comparison 2. The length of the cutaneous area between subnasal and labiale superious differed by 1mm and the length from the stomion to the gnathion differed by 1.5mm in comparison 1. The other measurements taken were the same. In comparison 2 only one difference was found which was the nose length as measured from the midnasal point to the nasal tip that differed by 3mm. This case study demonstrates the practical dilemma facing facial identification experts in law enforcement. Further cases need to be assessed in order to establish a trend in facial mapping.

Assessing the effects of tooth loss in adult crania using geometric morphometrics.

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In South Africa, high rates of interpersonal violence and murder have ignited an increased interest in the field of forensic anthropology. A multitude of forensic investigators have examined this particular population with the hopes of deriving population specific standards to increase the accuracy of biological profiles. Despite this, most of these studies were conducted on the remains of black individuals, use traditional morphometrics and none have investigated the effects of tooth loss on the craniofacial structures of white South Africans. As life expectancies increase, the question of how aging and tooth loss affects bony structures arises which warrants novel research using modern techniques. Hence, this study analysed the effects of tooth loss on white South African crania using geometric morphometric (GM) techniques. Two hundred and twenty nine (229) dry cranial specimens of white individuals were randomly selected from the Dart Collection housed at the University of the Witwatersrand. Both fixed landmarks and sliding semilandmarks were digitised on the viscero- and basicranium. Following this, curve data were acquired from the face, basicranium, the maxillary alveolar ridges, the zygomatics, the nasal aperture and the orbits. GM techniques were applied to determine the effects of tooth loss on the skull as a whole as well as its effects on the above mentioned curves. Results indicated that although a number of effects were seen when the skull was analysed in its entirety, only the maxillary alveolar ridges proved to be significantly affected when curves were analysed individually. As both upper facial height and palate shape were significantly altered, various osteometric measurements and qualitative traits may be affected. These traits are useful during the assessment and estimation of race and sex and hence this study demonstrates the importance of considering dental state when compiling biological profiles.

Case report: unusual cranial surgical trauma.

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In 2011, the severely decomposed remains of an adult were found in a deserted field in South Africa. Skeletal analysis revealed that the individual was an adult male of 30 - 60 years. Carnivore damage and incompleteness of the remains prevented a closer age estimate. Untreated dental disease indicated a lack of dental treatment, and it is unlikely that dental records exist. Extensive recent antemortem trauma was evident on the skull. A partly healed fracture of the skull stretched from the roof of the left orbit, through the frontal and parietal bones and ended about 4.5 cm above the left asterion. Its edges were rounded off, indicating some healing and survival (probably a few weeks) after sustaining this fracture. The left scapula had fractures that were also partly healed, probably of the same age as the cranial fracture. On the right side of the skull, several drill (Burr) holes were evident, suggesting that the individual had been treated for an intracranial bleeding. A large flap of the skull had been removed, and two smaller drill holes were present on the loose flap of bone. From the observed traumatic changes, it can be deducted that this person had suffered major blunt force trauma for which he received invasive surgery to the head. He has survived both the injury and surgery for some time, after which he died from unknown causes. Although hospital records should be available for this person, he could not be identified. Recently De Boer et al. published criteria by which partly healed fractures on dry bone could be dated using histology and radiography. Although this initial study was done on long bones, the methods were tested on this case as it would be of value to see if the same healing features can be identified on the cranium. It was concluded that histological and radiological assessment of dry bone can provide valuable information on post-traumatic survival of individuals in a forensic and archaeological context.

Synthetic faces for eyewitnesses and face recognition: Research and practice

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In this talk we present a software program (ID) for the synthesis of high resolution images of human faces, and discuss its applications to basic and applied research in face recognition. ID was developed at the University of Cape Town by CG Tredoux, in collaboration with researchers and students from the departments of Psychology, Computer Science, Mathematics, and Electrical Engineering. Face models are built using principal component analysis of 2D digital images, and these models are controlled with a GUI that allows a variety of manipulations, including control of facial similarity, and artificial scaling of faces on perceptual dimensions. Applications include composite face construction in interaction with eyewitnesses, manufacture of police identification parades scaled for suspect-foil similarity, and creation of artificial emotional facial expressions. Data will be presented from experiments that test the ability to manipulate perceptual dimensions, and the validity of the artificial emotional expressions generated by the software.

Facial soft tissue thickness differences among three skeletal classes in Japanese population.

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Facial reconstruction is a technique used in forensic anthropology to try to estimate the appearance of the antemortem face from unknown human skeletal remains. This requires accurate skull assessment (for variables such as age, sex, and race) and soft tissue thickness data. However, the skull can provide only limited information, and further data are needed to reconstruct the face. The authors herein obtained further information from the skull in order to reconstruct the face more accurately. Skulls can be classified into three facial types on the basis of orthodontic skeletal classes (namely, straight facial profile, type I, convex facial profile, type II, and concave facial profile, type III). This concept was applied to facial tissue measurement and soft tissue depth was compared in each skeletal class in a Japanese population. Differences of soft tissue depth between skeletal classes were observed, and this information may enable more accurate reconstruction than sex-specific depth alone.

Validation of a computational framework for CT-based cranio-facial reconstruction.

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Estimating the facial outlook from an unidentified skull is a challenging task in forensic investigations. This paper presents the testing and validation of a fully automatic pipeline for computerized craniofacial reconstruction (CFR). A database of age-, gender- and BMI-annotated full-head 3D cross-sectional Computed Tomography reference scan images is used. This database is continuously being upgraded with new reference cases. Furthermore, the procedure can be easily extended to include data of different ethnicities when such data become available. Facial and skeletal surfaces are automatically extracted and corrected for imaging artifacts or minor anatomical defects (e.g. missing teeth) for every image in the database. Reconstruction of the face of an unidentified skull (scanned 'as is', not requiring a time-consuming soft tissue removal procedure) is started by warping all skull surfaces in the database to the target skull. The resulting transformations are then applied to the associated facial surfaces resulting in as many warped facial surfaces as individuals in the database. A single consensus facial surface is generated by combining the individual reconstructions and taking into account gender, BMI and age matching. By implementing this procedure on a cluster platform, reconstructions can be obtained in less than 10 minutes, irrespective of the number of reference images, which is considerably shorter than current manual reconstruction procedures. Validation was performed using a cross-validation leave-one-out scenario where each image in the database was reconstructed using all other images in the database as reference. The reconstructed and actual facial surfaces are then compared using statistics of inter-surface distances. We tested the influence of meta-data such as gender, age, BMI and ancestry on the resulting reconstructions using Principal Component Regression. On a database of 72 reference individuals a maximal reconstruction error of 4 mm was obtained. Errors increased more for BMI mismatches than for age mismatches. Gender mismatches had the smallest influence.

Closing the eyes during witness interviews: Effects on subsequent facial recognition performance

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Research shows that instructing witnesses to close their eyes during an investigative interview can help them remember more about witnessed events. We investigated whether the benefits of eye-closure would extend to face recognition and line-up identifications. In Experiment 1, participants who thought about a previously seen face just prior to their recognition decision, either with eyes open or eyes closed, did not perform better than participants who completed an unrelated task. However, White participants were significantly better at recognizing White faces than Black faces, whereas Black and Coloured participants performed equally well for both types of faces. In Experiment 2, participants were interviewed about a witnessed theft and viewed a target-present or target-absent line-up. Eye-closure during the interview and just prior to viewing the line-up improved recall of the event, but did not affect line-up identifications. In conclusion, eye-closure improves recall of events, but does not affect face recognition or line-up identifications.

Do facial composites contaminate memory? A meta-analysis.

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Witnesses of serious crimes are often asked to construct a facial composite of the perpetrator's face to facilitate the search for a suspect. One potential danger of this practice is that witnesses will contaminate their memories for the original perpetrator—a large body of published research shows that the portraits witnesses create are rarely accurate representations. We conducted a meta-analysis of the empirical literature on facial composites to investigate how viewing or building a composite affects a witness's subsequent ability to recognise the perpetrator. We identified 16 studies, reporting 50 effect size comparisons. Constructing, or simply viewing, a facial composite significantly impaired participants' ability to recognise the perpetrator from a subsequent line-up (Odds Ratios ≈ .47). However, the effects reported in the literature were highly variable, and were driven by two studies in particular. If these studies are classified as outliers, the average, weighted effect of viewing or constructing a composite is not statistically significant. Implications for police practice will be discussed.

Craniofacial superimposition accuracy study.

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The aim of this research was to accurately compare manual and computerised craniofacial superimposition techniques and to establish the application of these techniques for disaster victim identification, where there may be a large database of passport-style images, such as the MPUB Interpol database. This study utilised the University of Tennessee database and included 20 skulls (10 male and 10 female) and face pools of 20 faces of similar sex and ethnic group. These results found that the profile and three-quarter views were the most valuable for craniofacial superimposition. However, the poor identification rate achieved using images in frontal view suggests that the MPUB Interpol database would not be optimal for disaster victim identification, and passport images do not provide enough distinguishing facial detail. This study suggested a standardised protocol for use in DVI situations. There was no significant difference in success between the manual and computer methods, and this suggests that digital technology is as reliable as traditional methods. This study concludes that craniofacial superimposition could be a useful tool in disaster victim identification for narrowing the possible identifications of individuals in a large scale closed disaster.

POSTER PRESENTATIONS

Use of superimposition of dental prosthesis to photographic dental image for identification: a case report.

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Dental identification of unknown human remains continues to be a relevant and reliable adjunct to forensic investigations. The advent of genomic and mitochondrial DNA procedures has not displaced the practical use of dental and related osseous structures remaining after destructive incidents that can render human remains unrecognizable, severely burned, and fragmented. The ability to conclusively identify victims of accident and homicide is based on the availability of antemortem records containing substantial and unambiguous proof of dental and related osseous characteristics. Absence of antemortem dental records is one of the important problems in the identification efforts by dental comparison. In these circumstances dental superimposition is becoming more and more important approach if there is only a photograph. Superimposition of teeth visible in an ante-mortem photograph and dental casts of an unidentified body is the procedure applied. In this case report, we used the antemortem photograph showing teeth for superimposition to the prosthesis found at scene. Smiling images from photographs were analyzed by using Adobe Photoshop (TM) software. After correction of distortion, incisor teeth and images of partial prosthesis were compared by using superimposition method. With the absence of antemortem radiographs, this method proved useful to reach a positive identification in this case.

A test of the accuracy of ancestry estimation in a southern African Khoesan cranial sample using FORDISC.

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The Khoesan of southern Africa is a biologically diverse group that includes individuals and groups from both a hunter-gatherer and agricultural background. The aim of this project was to use FORDISC to analyse a sample of Khoesan crania in order to test the accuracy of ancestry determination for this specific group and to assess the likelihood that all individuals belong to the same ancestral group, i.e. Khoesan. The sample comprised of 167 adult crania from four different skeletal collections in Europe and South Africa. Eighty one crania were from the Rudolf Pöch Skeletal Collection in Vienna, Austria, 25 from the Natural History Museum in London, 15 from the Musée de l'Homme in Paris, France and 46 from the McGregor Museum in Kimberley. All crania were analysed using FORDISC 3.0. The sample was tested against black and white males and females of the FDB (American Forensic Database), African groups from the Howells database, as well as a custom database containing black, white and coloured groups from South Africa. Results indicated that the majority of crania were classified as black when compared to the FDB. Using the Howells database, only about half of all individuals were grouped with the Khoesan. They were most often mis-classified as belonging to the Teita from Kenia. Lastly, about three quarters of crania were sorted into the South African black group when compared to the custom data base, with only a few individuals indicated as belonging to the coloured group. Therefore, the FORDISC program assisted in narrowing down the individuals' ancestry, although many were misclassified. These misclassifications may either be due to problems with the FORDISC database, or it is possible that all individuals were not Khoesan. Normal biological variation must also be taken into account. These findings need further investigation.

Image manipulations versus facial recognition.

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Investigators examining the Al Qaeda terrorist network determined that the terrorists were able to travel the world using fake passports and immigration documents. Many of these fake passport photos were digitally manipulated. Digital manipulation alters the algorithm of numbers generated by facial recognition systems and therefore the terrorists can avoid being detected via routine passport checks against a "watch list". The aim of this study was to test the potential algorithm of numbers, using a random face, against a set of digitally manipulated images of the same face, while attempting to maintain enough visual likeness to pass a manual check at border posts. A photo of an unknown male was used in this study. Visible facial landmarks and characteristics of individualization (e.g.: moles) were marked out by means of colored dots, similar to the technique implemented by 2D facial recognition systems. Subsequently, a dotted layer was created in Adobe Photoshop that was used as a template. The original photo was then manipulated digitally by means of Adobe Photoshop. This involved flipping the image, doubling the right side of the face to represent the left half, manipulating the image so that the individual presents as a thin version of his original image. The dotted template was compared against manipulated images by means of an overlay. In all cases the image maintained visual likeness, but the dotted template did not match the image. Preliminary results of this study indicate that images of passport and other travel/identity documents can be expertly manipulated digitally in order to avoid detection by means of algorithms generated and implemented by facial recognition systems whilst maintaining sufficient visual likeness to pass manual border posts.

Identification of a skull missing mandible via superimposition technique = a successful match confirmed by DNA analysis.

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Superimposition technique is one of the techniques used in several examinations in forensic field. It is the technique used for years in the craniofacial identification. It started as photographic superimposition, then video-superimposition was added and currently being applied as computerized by the help of various software. There are different approaches by different end users and there is no standardization in the technique. For a standard approach and method, there is currently a European Project named as "MEPROCS". The Superimposition technique has been practicing at Council of Forensic Medicine, Istanbul, Turkey, since 1994. A number of successful cases of identification were carried on. Those cases were complete skeletons and there was no missing part particularly in the cranial region. This case is an unidentified skull lacking the mandible. The prosecutor also sent a photograph of the possible missing woman at that region. Anthropological landmarks both on the photograph and the skull were pointed, the skull was positioned according to the photograph and superimposition technique was carried out by the help of the computer. The matching by superimposition only on the basis of cranial landmarks without using the ones of mandible was with a result acceptable. The decision of "matching" was reported to the prosecutor and then DNA comparison performed later confirmed this result. This positive identification case shows that even for the skulls without mandible, proper use of anthropological landmarks only on the skull can result in success in superimposition technique.

Historical faces.

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Facial Reconstruction is one of the effective methods used in forensic identification. Initial facial reconstructions were applied on the historical skulls. Though main concern of the method is to identify the forensic cases, there are increasing numbers of reconstruction of historical cases. The majority of these cases are exhibited in museums. Turkey is a rich country in terms of archeological heritage. Sometimes, skeletal remains of historical cases are referred to Council of Forensic Medicine for examination on assumption of a current crime. In addition to the reconstruction of current skulls, there are also facial reconstruction samples of these historical cases. Facial reconstruction of historical skulls attracts public and media attention and by this way it provides a chance to introduce this method to the public and also let the sculpture further develop his/her technique. In this presentation we share some of the reconstructed faces of historical cases with their brief histories.

Resilience of facial creases on embalmed cadavers.

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The post-mortem resilience of facial creases on cadavers was studied using donated bodies to the Centre for Anatomy and Human Identification (CAHID) in order to identify the efficacy of creases for identification of the dead. Creases were analysed on normal (pre-embalmed) and bloated (embalmed) to establish whether facial bloating would affect facial crease visibility. Embalming was chosen to simulate the effects produced by post-mortem decomposition and bloating. Results suggest that facial creases are present on bloated faces and changes were present on creases located periphery of the face, particularly at areas where no facial skeleton underpins the skin such as cheeks. Two new creases not present in current literature were also discovered. The creases were called vertical superciliary arch line and lateral nose crease. Creases are resilient on bloated faces and could be utilised for human identification.

Dental age estimation charts specifically on the Turkish children and juveniles for the identification of mass fatality victims.

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Dental charts have been used in age estimations for many years. Atlas style age estimation charts were very effective and efficient materials, especially for the identification of juvenile mass fatality victims. Many studies which have been practiced up to now show that dental development varies between different populations. That is why population-specific dental charts are needed to be formed in order to estimate ages more correctly. In this study, the aim was to form (similar format to AlQahtani et al) dental age estimation charts which are formed in digital environment for both sexes between 4.5 – 22.5 age interval in Turkish children and young adults. A total of 753 Digital Panoramic Radiographs (DPRs), from 350 males and 403 females, have been assessed. Permanent teeth were evaluated by a classification system described by Demirjian et al. (modified). Eruption position was assessed with Olze's criteria by considering alveolar bone eruption of the teeth in four positions. Females in general preceded males in tooth development; this was particularly noticeable between the age groups 5 and 14 years. But this difference was usually visible in only one stage, not in all teeth. It has been determined that mixed dentition period ended with the shedding of second deciduous molars in both sexes. Charts which are presented here provide datasets in preliminary dental age estimation for identification of Turkish children and young adults who died in mass fatality disasters.

Identification of the facebook rapist by means of an identikit.

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Information regarding a man suspected of being the 'Facebook rapist" helped to construct an identikit with such close resemblance that the perpetrator was arrested and subsequently sentenced to life imprisonment. The man, who used the name Thomas Bester (22), used the social network to meet and promise women modelling contracts. He then raped and robbed them at knife point. He murdered one of the women who stayed at a guesthouse in Cape Town. An identikit was constructed based on the information provided by the guesthouse owner and the security guard. Specific details on which the identikit was based, was that he was a very well spoken, polished individual with a neat appearance. His hair was neatly short shaven. This, as well as all the other facial features that were described to me, assisted the detective as it was very accurate and he could link the suspect to the murder case.

The aid of 3D reconstruction in Post-mortem imaging: A case study.

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Post-mortem photographs were received from the investigating officer and the forensic artist was requested to perform a facial compilation in order to assist in identification of the deceased. Standard facial landmarks were used to render an accurate three dimensional model by means of visual effects software Autodesk Maya, Pixologic Z-Brush and Adobe Photoshop. The model was digitally modelled, textured and painted until a satisfactory resemblance of the deceased was achieved. The three dimensional model was then rotated to match the angle and direction of the subject and to examine accuracy. Last mentioned was achieved by loading the photo into the 3D software by means of a template or ''background''. The model, within 3D space, could be matched in any direction (co-ordinate xyz) against the photo in the background. The model was then further refined and circulated in the media in order to reach the widest audience for a possible identification. In conclusion, a three dimensional model can greatly aid in the task since it is possible to take most facial features into account as different views can be utilized. In addition, a three dimensional model can be rotated at any angle and compared to photographs of the deceased.

Dental modification in South African archaeological human remains

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Dental modification is a common practice often observed in African populations especially from the sub-Saharan regions. Modifications may include the extraction, chipping or filling of especially the incisors and canines. This practice may be observed in both men and women, and is often performed as a means of cultural identification or as part of an initiation ritual to symbolize the coming of adulthood. Even though, dental mutilations are less common in South Africa than elsewhere in Africa, it is still observed in some Iron Age and historical communities and probably reflects the inheritance of cultural practices predating the migration of Bantu speaking populations into southern Africa. Such dental modifications could conceivably express symbolic identities and may be associated with specialist knowledge with strong religious and symbolic underpinnings such as metal working, as seems to be the case at Ben Alberts, Phalaborwa and Farm Laaste. Skeletal remains recovered from these sites include both men and women, most of whom showed evidence of tooth modification associated with the filling or sharpening of the incisors. These individuals were all buried in close proximity to iron smelting activities, as suggested by the associated artefacts and features, denoting a specific symbolic identity different to that placed on individuals who were buried elsewhere. Although, these extreme styles of mutilation no longer exist in modern South Africans, some attempts at dental adornment are still sometimes found such as in the case of the Cape Flats smile and other recent forensic cases.

Chin shape in South Africans.

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The mandible is often used to estimate sex and age from unknown remains, as it is the largest and hardest facial bone and is thus often preserved. Amongst other markers on the mandible, the shape of the chin has been linked to aging, sex, and population affiliation.The shape of the chin is thought to be influenced by mechanical stresses of mastication and speech production or according to the sexual selection hypothesis whereby preferential mate selection is involved in the evolutionary development of morphological sex differences. Sex differences in the chin are considered to occur during the extended growth period of the relatively delayed puberty in males. The purpose of this study was to investigate the chin shape differences in various sex-population groups. The dried mandibles of 128 individuals (34 black females, 31 black males, 31 white females and 32 white males) from the Pretoria Bone Collection were included. Images generated by cone beam computed tomography from Necsa (nuclear energy corporation of South Africa), were used to apply the following landmarks: gnathion, pogonion, left and right mental tubercle as well as the deepest point on the anterior midline. Using Morphologika, the principal components of variation between specimens were analysed for shape variations. Significant differences ($p<0.05$) existed between populations in those with dentition as well as those with tooth loss. The differences between sexes overall and within populations were not significant. Significant chin shape changes could be demonstrated with loss of teeth in whites which could be ascribed to the older age of this group and therefore a longer possible time without functional dentition for remodelling to take place. The shape differences noted between populations might be explained on the basis of different masticatory stresses, including the positioning of the facial muscles during chewing.

History of facial identification in the South African Police Service.

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The Facial Identification Section was founded in 1975 as part of the South African Criminal Bureau. The Section was initially not regarded as an independent functionary body, but rather as a special service attached to the Wanted and Missing Persons Bureau. In 1984, demand for the service increased dramatically after a local magazine published a photograph of Nelson Mandela, who at that stage, still was a prisoner on Robin Island. At the time, the Safety and Security law prohibited the publishing photographs of political prisoners, which meant that the publication of Mr Mandela's photo was illegal. The magazine argued that the photograph was of a look-alike of Mr Mandela, and not a real photograph of him. Subsequently, the South African Police conducted a photographic comparison using various morphological characteristics. It was determined that the photograph in question was indeed that of Mr Mandela, and the magazine had to withdraw all the printed copies of the issue. The expertise, methods and technology used by the members of the unit have significantly improved over the years since this landmark case. The Unit currently consists of 25 offices and 53 facial identification experts countrywide. They are accountable for identification of more than 10 000 faces of criminals per year in the investigation of crime. In order to keep up to date, members have moved away from the card system and now use advanced software and laptops for facial identification. They also receive training by local and international experts in conjunction with the Forensic Anthropology Research Centre, University of Pretoria. The investment made by South African Police Service in the Unit's members by developing their skills and knowledge level has paid dividends in court. As a result, the Facial Identification Unit has become a sought after specialized unit in the South African Police Service.

Craniofacial identification of historical persons.

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Craniofacial reconstruction was used to regain the face from a skull found in Ermolov's crypt and another skull found in Novoierusalimsky monastery, which presumably belongs to Arkadiy Suvorov, the son of the famous A. V. Suvorov. Alexey Petrovich Ermolov (1777 – 1861) was a Russian military leader and statesman, who took part in many great wars. According to historical data, the crypt contained the remains of A. P. Ermolov, his father and his son. Only one skull was found here. A burial found in Novoierusalimsky monastery presumably belongs to Arkadiy Suvorov (1784 – 1811). We also have intravital portraits of Arkadiy Suvorov, A. P. Ermolov and his son. Analysis of the human remains was needed in these cases. The problem was

1) to determine to whom the skull from Ermolov's crypt belonged;
2) to identify the burial from Novoierusalimsky monastery.

The Laboratory of Anthropological Reconstruction is constantly developing the facial reconstruction method according to the newest scientific innovations. The frontal and profile reconstructions were made from above mentioned skulls. The faces' proportions were matched; reconstructions and portrait details were also put together.

Case 1: Ermolov's family crypt

Statistically there were many matches of indexes and landmarks between the skull from the crypt and Ermolov's father's portrait, which made it possible to identify the skull as belonging to his father.

Case 2: Burial from Novoierusalimsky monastery

The reconstruction and A. Suvorov's portrait corresponded in most of the indexes and landmarks, which gives grounds for identifying the remains found as belonging to the son of the famous military leader. Modern approaches to anthropologic reconstruction methods enable us to make craniofacial reconstruction of high accuracy – both for forensic science and for historical facial reconstruction.

In search of endorsement: African skulls in foreign collections.

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As part of a bigger project aimed to stimulate further research and raise awareness regarding African remains housed in foreign skeletal collections, the catalogues of the Anatomical Museum of the Leids Universitair Medisch Centum (AM-LUMC) were searched for skeletal remains of African origin. Eighteen adult specimens were documented to originate from Africa. Documentation of the origin of the remains were however poor, severely limiting their value in further research. An attempt was therefore made to try and confirm the origin of the remains by means of craniometry. Multivariate discriminant function analyses (MDA) were performed with different comparative samples from Sub-Saharan Africa compiled from various studies. The results of the MDA were compared to results generated using FORDISC in order to gain insight into how the origin of the samples used for comparison influence the outcome of the possible origin of the crania. Both the MDA and FORDISC results obtained supported that one individual documented to be a "Dutch Cape of Good Hope Farmer" was of European descent and that the rest of the individuals most likely originated from Africa. Although FORDISC could support the general geographical (Sub-Saharan) origin of the remains, the incorporation of population samples from which the remains were suggested to originate into discriminant function analyses, proofed to be a valuable addition to endorse more specifically the origin of some of the crania.

University of Pretoria cadaver photo research collection.

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In many countries such as South Africa DNA testing and dental records are unrealistic as far as personal identifications are concerned, as one needs a data bank and/or a comparative DNA sample. As a result only a small percentage of skeletal remains recovered are positively identified. Research on skull-photo superimposition, facial reconstruction and other means of identification could improve these statistics. Collections where crania with their facial images are available are difficult to come by whilst obtaining living photographs may be a sensitive issue. The University of Pretoria began compiling facial photographs (anterior and lateral) of donated bodies in the 1970s and has grown to include over 800 facial photographs. This resource was used in a study by Gordon and Steyn in 2012 on skull-photo superimposition. One shortcoming of cadaver photographs is the degree of post-mortem facial distortion; nevertheless this is a valuable source of information that can be used with success in various avenues of research. Additionally, some cadaver records include ID photos which provide an alternative source of facial information. This poster presents the facial data available at the University of Pretoria. The data has been sorted into the following categories; number of skulls with corresponding ID photographs (±80), number of skulls with cadaver photographs (±700) and the number of skulls with both ID and cadaver photographs (±70). Other research avenues include reliability testing of skull-photo superimposition and facial approximations, evaluation of the accuracy of post-mortem depictions and evaluation of the relationship between dimensions taken with photo-anthropometry and craniometry.

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