



# INTERNATIONAL JOURNAL FOR LEGAL RESEARCH AND ANALYSIS

Open Access, Refereed Journal Multi Disciplinary  
Peer Reviewed Edition :

[www.ijlra.com](http://www.ijlra.com)

## **DISCLAIMER**

No part of this publication may be reproduced or copied in any form by any means without prior written permission of Managing Editor of IJLRA. The views expressed in this publication are purely personal opinions of the authors and do not reflect the views of the Editorial Team of IJLRA.

Though every effort has been made to ensure that the information in Volume 2 Issue 7 is accurate and appropriately cited/referenced, neither the Editorial Board nor IJLRA shall be held liable or responsible in any manner whatsoever for any consequences for any action taken by anyone on the basis of information in the Journal.

Copyright © International Journal for Legal Research & Analysis

IJLRA

## **EDITORIAL TEAM**

### **EDITORS**

#### **Megha Middha**



*Megha Middha, Assistant Professor of Law in Mody University of Science and Technology, Lakshmangarh, Sikar*

*Megha Middha, is working as an Assistant Professor of Law in Mody University of Science and Technology, Lakshmangarh, Sikar (Rajasthan). She has an experience in the teaching of almost 3 years. She has completed her graduation in BBA LL.B (H) from Amity University, Rajasthan (Gold Medalist) and did her post-graduation (LL.M in Business Laws) from NLSIU, Bengaluru. Currently, she is enrolled in a Ph.D. course in the Department of Law at Mohanlal Sukhadia University, Udaipur (Rajasthan). She wishes to excel in academics and research and contribute as much as she can to society. Through her interactions with the students, she tries to inculcate a sense of deep thinking power in her students and enlighten and guide them to the fact how they can bring a change to the society*

#### **Dr. Samrat Datta**

*Dr. Samrat Datta Seedling School of Law and Governance, Jaipur National University, Jaipur. Dr. Samrat Datta is currently associated with Seedling School of Law and Governance, Jaipur National University, Jaipur. Dr. Datta has completed his graduation i.e., B.A.LL.B. from Law College Dehradun, Hemvati Nandan Bahuguna Garhwal University, Srinagar, Uttarakhand. He is an alumnus of KIIT University, Bhubaneswar where he pursued his post-graduation (LL.M.) in Criminal Law and subsequently completed his Ph.D. in Police Law and Information Technology from the Pacific Academy of Higher Education and Research University, Udaipur in 2020. His area of interest and research is Criminal and Police Law. Dr. Datta has a teaching experience of 7 years in various law schools across North India and has held administrative positions like Academic Coordinator, Centre Superintendent for Examinations, Deputy Controller of Examinations, Member of the Proctorial Board*



## **Dr. Namita Jain**



*Head & Associate Professor*

*School of Law, JECRC University, Jaipur Ph.D. (Commercial Law) LL.M., UGC -NET Post Graduation Diploma in Taxation law and Practice, Bachelor of Commerce.*

*Teaching Experience: 12 years, AWARDS AND RECOGNITION of Dr. Namita Jain are - ICF Global Excellence Award 2020 in the category of educationalist by I Can Foundation, India. India Women Empowerment Award in the category of "Emerging Excellence in Academics by Prime Time & Utkrisht Bharat Foundation, New Delhi.(2020). Conferred in FL Book of Top 21 Record Holders in the category of education by Fashion Lifestyle Magazine, New Delhi. (2020). Certificate of Appreciation for organizing and managing the Professional Development Training Program on IPR in Collaboration with Trade Innovations Services, Jaipur on March 14th, 2019*

## **Mrs.S.Kalpana**

*Assistant professor of Law*

*Mrs.S.Kalpana, presently Assistant professor of Law, VelTech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi. Formerly Assistant professor of Law, Vels University in the year 2019 to 2020, Worked as Guest Faculty, Chennai Dr.Ambedkar Law College, Pudupakkam. Published one book. Published 8Articles in various reputed Law Journals. Conducted 1Moot court competition and participated in nearly 80 National and International seminars and webinars conducted on various subjects of Law. Did ML in Criminal Law and Criminal Justice Administration. 10 paper presentations in various National and International seminars. Attended more than 10 FDP programs. Ph.D. in Law pursuing.*



## **Avinash Kumar**



*Avinash Kumar has completed his Ph.D. in International Investment Law from the Dept. of Law & Governance, Central University of South Bihar. His research work is on "International Investment Agreement and State's right to regulate Foreign Investment." He qualified UGC-NET and has been selected for the prestigious ICSSR Doctoral Fellowship. He is an alumnus of the Faculty of Law, University of Delhi. Formerly he has been elected as Students Union President of Law Centre-1, University of Delhi. Moreover, he completed his LL.M. from the University of Delhi (2014-16), dissertation on "Cross-border Merger & Acquisition"; LL.B. from the University of Delhi (2011-14), and B.A. (Hons.) from Maharaja Agrasen College, University of Delhi. He has also obtained P.G. Diploma in IPR from the Indian Society of International Law, New Delhi. He has qualified UGC - NET examination and has been awarded ICSSR - Doctoral Fellowship. He has published six-plus articles and presented 9 plus papers in national and international seminars/conferences. He participated in several workshops on research methodology and teaching and learning.*

## **ABOUT US**

INTERNATIONAL JOURNAL FOR LEGAL RESEARCH & ANALYSIS

ISSN

2582-6433 is an Online Journal is Monthly, Peer Review, Academic Journal, Published online, that seeks to provide an interactive platform for the publication of Short Articles, Long Articles, Book Review, Case Comments, Research Papers, Essay in the field of Law & Multidisciplinary issue. Our aim is to upgrade the level of interaction and discourse about contemporary issues of law. We are eager to become a highly cited academic publication, through quality contributions from students, academics, professionals from the industry, the bar and the bench. INTERNATIONAL JOURNAL FOR LEGAL RESEARCH & ANALYSIS ISSN 2582-6433 welcomes contributions from all legal branches, as long as the work is original, unpublished and is in consonance with the submission guidelines.

# **TECHNIQUES IN FACIAL RECONSTRUCTION: A FORENSIC ANTHROPOLOGICAL PERSPECTIVE**

**AUTHORED BY: ISHAAN DEEPAK JOSHI**

NALSAR University of Law and MIT-WPU Faculty of Law

**Email:** ishaanjoshi2k@gmail.com

**Phone no:** +91 9158636644

## **Abstract**

The process of identifying human remains involves considering several elements, with the face being recognised as a distinctive characteristic that can be utilised for accurate identification. The face assumes a crucial function in authentication when DNA or biometric analyses are not feasible. Porter & Doran note that fingerprints are a more dependable means of identification, however facial images assist non-experts in making identifications by matching the suspect in issue with their portrait or sketch. The objective of forensic facial reconstruction is to utilise a skull in order to develop a visage that can be employed for the identification of the individual to whom the skull pertains. An effective forensic facial reconstruction will yield a countenance that can be readily and properly recognised as belonging to the individual whose skull it originated from. The importance of facial reconstruction procedures in forensic work has led to the creation of many methods for facial reconstruction. This research aims to elucidate the fundamental principles of forensic facial reconstruction and conduct a thorough evaluation of its practical utility. This analysis will evaluate several widely-used techniques for facial reconstruction, emphasising their inherent advantages and disadvantages.

## **Forensic Principles in Facial Reconstruction**

Face reconstruction is the method of creating facial features, typically for individuals whose identity is unknown, based on their skull structure. The underlying principle of this procedure is the concept that the structure of the skull is closely linked to the external appearance of the face. However, establishing this association is challenging due to the uneven distribution of soft tissues over the skeletal structure.<sup>1</sup> Hence, the contentiousness around the precision of facial

---

<sup>1</sup> Porter, G., & Doran, G. (2000). An anatomical and photographic technique for forensic facial identification. *Forensic Science International*, 114 (1), 97-105.

reconstruction techniques arises, with certain scholars casting scepticism on the technologies' capacity to faithfully replicate a visage that can be readily and accurately identified as the intended person.<sup>2</sup> Furthermore, the skull lacks any distinctive features including as birthmarks, scars, or moles that can serve as identifying markers for an individual.

Clement & Murray concede that the process of fully rebuilding a face from a skull devoid of any flesh is exceedingly challenging due to the limited knowledge of the precise connections between the bony structure and the soft tissues. The link between the cranium and the facial features is intricate due to the existence of adipose tissue, muscular tissue, and connective tissue. Stephan & Simpson state that when determining the depths of facial soft tissue, no specific anatomical component of the face provides discriminative information.<sup>3</sup>

Furthermore, facial approximation algorithms lack the capability to ascertain attributes such as facial colours and textures based on the skull.<sup>4</sup> Hence, accurately determining the skin depth just from the exposed skull remains unattainable, even when considering a substantial dataset encompassing a diverse range of individuals.

Despite the challenges associated with producing precise anatomical reconstruction of the visage, forensic facial building has been effective in establishing leads or initial identifications in numerous forensic instances. According to Wilkinson, forensic facial reconstruction is employed by the police in cases when they lack a suspect for identification purposes. The face is widely regarded as the most influential area of the body when it comes to assisting with identifying endeavours. Oxenham asserts that the face possesses very distinctive configurations, making facial reconstruction methods highly valuable for identifying purposes.

Facial reconstruction serves the purpose of not only determining the identity of the skull's owner, but also plays a crucial role in eliminating potential suspects. Anthropologists utilise forensic facial reconstruction to replicate the facial appearances of early humans and hominids. This tool aids anthropologists in their examination of the evolutionary transitions from hominids to modern humans. Recent technological advancements have empowered anthropologists to utilise several

---

<sup>2</sup> Oxenham, M. (2008). *Forensic Approaches to Death, Disaster and Abuse*. Sydney: Australian Academic Press.

<sup>3</sup> Stephan, C.N., & Henneberg, M. (2001). Building faces from dry skulls: are they recognized above chance rates? *J Forensic Sci*, 46(3), 432–440.

<sup>4</sup> Clement, J.G. & Murray, K.M. (2005). *Computer-Graphic Facial Reconstruction*. NY: Academic Press.

methodologies that have facilitated more precise identification.

## Methods for Restoring Facial Structure

The initial endeavours in facial reconstruction focused on aligning the skulls of renowned individuals with their corresponding pictures and sculptures. The unidentifiable craniums were overlaid over the visuals of the presumed possessor to ascertain if they corresponded. Nevertheless, the importance of facial reconstruction in the process of reconstructing the appearance of unidentified individuals has increased. Consequently, researchers have focused on developing methods to reconstruct the features of unidentified individuals based on their skulls.<sup>5</sup> Facial forensic reconstruction generally utilises the skull to estimate the appearance of the face, although physical remnants on the skeletal framework also contribute to this procedure. The presence of soft tissue remnants aids the practitioner in more accurately estimating the thickness of soft tissue, hence reducing the inherent inaccuracies associated with the procedures used to measure soft tissue thickness.

### Two-dimensional Reconstruction

Tissue depth markers are affixed to the skull being identified to create an outline sketch of skulls from both frontal and lateral perspectives. Oxenham illustrates that the primary sutures of the skulls, which are often referred to as anthropological landmarks, are the main points of interest for attaching these depth indicators. Artists can create 2-D facial reconstructions using the photographic prints generated through this process. According to Wilkinson, this technique enables police artists to rebuild the facial features of decomposing individuals and accurately determine the identity of the skull's original owner.

The conventional method of facial reconstruction in two dimensions was a manual process where facial drawings were created on overlays and then overlaid onto skull photographs. In the manual method, the practitioner may sketch the facial muscles on the preliminary overlay or immediately draw the completed face over the skull pictures. Caldwell enhanced the 2D technique by suggesting the utilisation of life-sized anterior and peripheral views of the skull, followed by the incorporation of tissue depth information based on Krogman's standards.

---

<sup>5</sup> Wilkinson, C. (2004). *Forensic Facial Reconstruction*. Cambridge: Cambridge University Press.

The conventional two-dimensional reconstruction technique has made notable progress in recent decades as a result of the implementation of computer programmes in the procedure. Computerised 2D facial reconstruction utilises specialised computer software built exclusively for this task. The software application is utilised to generate a facial composite based on a photograph of the cranium. The programme retrieves facial outlines and traits from a database it maintains, and then incorporates them. The face features are contingent upon the musculoskeletal structure & its origins.

Mikhail Gerasimov, a well-known Russian Anthropologist, proposed that accuracy issues may arise when the investigator neglects to adequately consider the muscular structure and the interrelationship between the facial form and the unique characteristics of the cranium. The precision of 2D reconstruction is contingent upon the expertise of the practitioner. According to Ullrich and Stephan, Gerasimov's face approximation technique, which considered muscle structure, reached nearly perfect accuracy of around a hundred percent.<sup>6</sup>

### **Advantages**

Utilising computer software programmes for 2D reconstruction expedites the process and yields a rapid approximation. Modifications to the finalised image can also be easily applied utilising the editing capabilities of the software. This technique does not necessitate the utilisation of advanced equipment to generate the facial estimation.<sup>7</sup> Consequently, it can be utilised by laboratories that do not own contemporary equipment. The significance of this issue is important, as a scarcity of resources can impede forensic teams in their execution of facial reconstruction.

### **Limitations**

This facial restoration approach is equally susceptible to the subjective influence of the reconstructor. According to Wilkinson, the reconstructor's perceived subjectivity will have a significant impact on the result of the procedure. The accuracy of 2D reconstruction using manual techniques relies heavily on the skill and proficiency of the artist. The correctness of the reconstruction primarily depends on the individual reconstructor's level of talent and expertise.

---

<sup>6</sup> Ullrich, H., & Stephan, C. (2011). On Gerasimov's Plastic Facial Reconstruction Technique: New Insights to Facilitate Repeatability. *J Forensic Sci*, 56 (2), 470-474.

<sup>7</sup> Damas, S., et al. (2011). Forensic identification by computer-aided craniofacial superimposition: a survey. *ACM Computing Surveys*, 43(4), 1-31.

The reconstruction practitioner employing this technique must possess sufficient expertise and a comprehensive comprehension of facial anatomy & physiology to produce a sufficiently precise facial reconstruction.

### **Three-Dimensional Sculpture**

Gatliff Betty created the 3-D approach based on the research of Krogman. Gatliff identified the significance of facial asymmetry during her efforts to rebuild the visage of a Native American male. According to Wilkinson, Gatliff only recreated part of the face in the particular case and produced a whole face by utilising mirror image photographs. There exist two distinct strategies for 3-D facial reconstruction: the American method and the Russian method. In the American approach, the skull is affixed to a stand and data regarding average tissue thickness is obtained from several tables that pertain to different age groups, ethnicities, and genders. The practitioner chooses the most suitable combination of tissue density parameters and cuts vinyl rubber cylinders to the corresponding thickness. The pieces are adhered to the cranium at the precise anatomical locations, and strips of modelling clay are employed to link these marks together. By performing this process, a rudimentary topographic representation of the facial surface is generated, and the remaining exposed areas are filled in order to simulate the appearance of a face. An artist is then employed to sculpt the facial features, including the eyes, lips, nose, & ears. According to Wilkinson, the facial traits are derived from specific information gathered from the skull, which could potentially indicate the skull's origins.

### **Advantages**

The presence of a three-dimensional representation of the face leads to a heightened level of realism, so aiding in the process of identification. Stephan & Henneberg have documented that the utilisation of a 3D model considerably enhances the ability to identify objects beyond random chance. The employment of the Russian approach, which involves the development of facial muscles, can greatly enhance accuracy levels.<sup>8</sup> Utilising 3D sculptures enables the analyst to physically see the texture of the skull, facilitating the inclusion of crucial skeletal intricacies in the facial reconstruction procedure. The presence of suitable facial characteristics greatly aids non-experts in making precise identifications.

---

<sup>8</sup> Stephan, C.N., & Henneberg, M. (2001). Building faces from dry skulls: are they recognized above chance rates? *J Forensic Sci*, 46(3), 432–440.

## Limitations

The reconstructions rely on a limited number of data points that provide height information. The majority of the facial features are then constructed using interpolated data, resulting in a reduction in the precision of the recreated face. If the degree of error is excessively high, it will be unfeasible to achieve a definitive identification using the recreated face. Another drawback of this approach is its time-consuming nature, as well as the necessity for the practitioner to possess extensive anatomical and forensic expertise in order to achieve a precise reconstruction.

## Three-Dimensional Computed Tomography Scan

CT scans are invaluable in cases where utilising the authentic skull of an unidentified individual is not feasible. The technology of stereolithography utilises CT scans to create an accurate replica of an individual's skull with great precision. The CT scan from the skull can be replicated using 3D printing or it can be digitally altered as a computer model. The modification of the model allows for the entire computerization of the tissue restoration process. The dowels, serving as a reference for the reconstruction process, are seamlessly incorporated into the CT image using software, facilitating effortless editing.

## Advantages

The CT-generated 3D scan is devoid of any geometric aberrations. CT images are useful initial steps in computer-assisted craniofacial reconstruction. According to Choras, the scan produces highly precise results, allowing for the identification and triangulation of equipotential planes. The CT scan produces undistorted three-dimensional pictures of the skull due to its non-invasive nature.<sup>9</sup> According to Choras, it provides as a starting point from which various methods of tissue restoration can be executed. The practitioner has the ability to adjust the elevation of the dowels, so effortlessly altering the facial appearance. According to Clement and Murray, the ability to easily manipulate facial features allows for a rapid facial reproduction process. CT scan pictures can be stored as data files, enabling subsequent identification of individuals despite the lack of the actual skull. This concept holds great significance in a culture that practises cremation, which involves the destruction of human remains.

---

<sup>9</sup> Choras, S.R. (2011). *Image Processing & Communications Challenges*. Boston: Springer.

## Limitations

Specialised equipment is necessary to generate the 3D scans using this method. This equipment may be unavailable in certain laboratories, rendering this procedure inaccessible to certain forensic practitioners. When rebuilding a face using the acquired scan, averaging techniques are employed to calculate the dimensions of the tissue. The extensive dependence on averaging procedures in this technique amplifies the margin of error in the ultimate reconstruction.

## Superimposition

Superimposition is a method that entails overlaying the skull of the individual with the picture of a person who is believed to be the bearer of the skull. According to Ishii et al, PC-assisted craniofacial superimposition is the predominant method employed. The suspected individual's photograph is overlaid onto an x-ray scan of the skull to determine if there is a resemblance. In order to employ this technique, it is necessary to eliminate all remaining soft tissue from the skull. Implementing this will enhance the precision of the superimposition approach. When it is undesirable to remove the soft tissue, CT images might be employed for superimposition, as they closely resemble actual skulls.

## Advantages

Superimposition is highly efficient in excluding suspects as it can precisely ascertain that the skull doesn't correspond to a certain individual. The precision of this procedure is exceptionally high, particularly when high-quality pictures of a suspect are accessible. This technique can aid in the authentication of human remains even after the corporeal skeleton has been discarded. Ishii explains that by digitising skull pictures, it becomes possible to overlay them onto facial photos of potential suspects at a later time.<sup>10</sup>

## Limitations

One significant drawback of this approach is typically that the forensic squad must possess a roster of potential culprits to compare with the skull. Therefore, a certain level of understanding of the identification of the skull is necessary in order to utilise this procedure. Insufficient understanding renders the utilisation of this approach in facial reconstruction endeavours unattainable.

---

<sup>10</sup> Ishii, M. et al. (2011). Application of Superimposition-Based Personal Identification Using Skull Computed Tomography Images. *J Forensic Sci*, 56 (4), 960-966.

The absence of high-quality images hinders the precision of superimposition, as clear pictures are essential for the procedure. Aulsebrook et al. observes that the majority of individuals exhibit a smiling expression when being photographed, which poses a challenge for overlaying the mouth. The illumination in the majority of images is likewise indistinct, with certain areas of the face being veiled.<sup>11</sup>

## Concluding Remarks

The objective of this study is to examine forensic facial reconstruction & evaluate various approaches employed, along with their advantages and disadvantages. The discussion commenced by emphasising the significance of the face in discerning an individual's identity.<sup>12</sup> A comprehensive assessment has been conducted on the primary methods used for facial reconstruction, including 2D and 3D sculptures, 3D CT scan, & Superimposition. The paper has emphasised the utilisation of facial reconstruction software to address the limitations of human techniques. The article highlighted that facial reconstructions do not precisely replicate the visual representation of the individual. Every forensic facial reconstruction methodology has inherent limitations, making it impossible to completely eradicate all issues and achieve a precise depiction of the subject's face.<sup>13</sup> However, the approaches can generate a facial representation that closely resembles the original person, aiding in their identification by others familiar with the skull bearer.

---

<sup>11</sup> Aulsebrook, W.A., Iscan, M.Y. Slabbert, J.H., & Becker, P. (1995). Superimposition and reconstruction in forensic facial identification: a survey. *Forensic Science International*, 75 (1), 101 – 120.

<sup>12</sup> Joshi, I.D. (2022) *Analysis Of Various Approaches Of Criminal Profiling And Psychological Assessment*, *Indian Journal of Law and Legal Research*. Available at: <https://www.ijlra.com/post/analysis-of-various-approaches-of-criminal-profiling-and-psychological-assessment-1>

<sup>13</sup> Rosalie, D. (2008). *Egyptian Mummies and Modern Science*. Cambridge: Cambridge University Press.