Forensic Facial Reconstruction Using 3-D Computer Graphics

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Abstract:

Forensic facial reconstruction is a quick, non – destructive and well organized technique. It can be used to find unspecified human corpse when other techniques not succeed. The techniques has been of two types 2D and 3D. Facial reconstruction visual recognition by the respective family and companions to become simple and more specific. It can be utilized as a dominant forensic tool which may support in facial examination of the skull and eventually lead to positive recognition of an individuals. Forensic facial reconstruction is an association of both technical methods and creative skull. It can be applied to reconstruct the soft tissues onto the skull with the aim of acquire the image of an individual for his/her identification and determination. It has been employed in both forensic science and Archaeology. The 3D manual techniques used in forensic facial reconstruction are the Anatomical(Russian), Anthropometrical(American) and Combination Manchester (British) methods which are organized by the scientists namely Gerasimov, Krogman and Neave. Forensic facial reconstruction methods which is constructed using the TCL/Tk scripting language, the latter marking use of the C3D system.

Keywords: *Forensic facial reconstruction, 3D methods, identification.*

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Introduction

The uncovering of skeletalised decomposed or badly disfigured remains where specification is unrevealed and not impressed to belong to a individual person leaves the examiner with very little to associate with personal determination. In such cases one is restricted to the common features of the determination such as age, sex, race, stature and build. The purpose such reconstruction is to activate the identification process to see even if a name can be applied to a face. It is not declared that a reconstruction will provide an exact similarity of the person during life. A number of rightness studies using traditional 3D manual methods have indicate good levels of similarity to the pointed faces. Firstly considerable enquiries are made and documents of missing persons carefully analyzed. If it has not been practicable to determine the corpse when the usual path have been take a look at, then the feasibility of the reconstruction of the face from skull is observed **(Gupta *et al.,* 2015; Wilkinson & Caroline, 2010).**

Methodology

To produce reconstructed face from a skull the procedures should be follow are:-

- **Anthropological assessment of the skull**

Before presenting reconstruction procedure it is needed to make a extensive assessment of the skull for age, race and sex. And also the construct of the person and stature may be discover findings such as clothing and related things. It is necessary to conduct a careful analysis of the skull.

- **Preparation of the skull**

The main benefits of the computerized system has over physical carving methods is that there is no need to provide a cast of the skull. The technique of procuring an image of the skull is non – destructive and non – disasters and the actual skull used is rotated on a platform and a laser beam screened on to it. Once this has been finished then the skull stored safely away. It is essential that all faults and natural orifices should be stop up with cotton wool or any other things like that to keep stay away from data loss and that the screened laser beam does not pass through the sample. Skull keep on the platform for rotation process is attained by locating the base of the skull on a cylinder. Plasticine which has the ability to cling to bone and is hard to detach so that it should be keep away **(Lee *et al.,* 2011).**

- **Data acquisition**

A laser scanning system for estimating facial features is used here. With the room in darkness a thin beam of light is ejected from the laser and hit a small cylindrical prism filter in front which fans it out to provide a vertical line on the skull. The laser used is low power and the power does not extended. When a live subject' s face is scanned, there is no danger to the person, it is commended that the beam is not considered directly any closer than 30cm from the laser source **(Lee *et al.,* 2011).**

The skull should be fixed on a platform which is rotated through 360° under computer command at a distance of 1mm from the laser source. The height of the platform and chair can be modify as required. An optical shaft encrypt is combined to the platform and as the skull or subject turns a series of profiles are seized a arranged the break. The brightened profile is shine back off two sets of mirrors enhancing two profile lines which are observed by a video camera is corresponding to the distance of the profile from the centre of rotation. By calculating the distance between comparable points on the two profile lines can provide a set of separate points on the original profile. As the objects constant to rotate the profiles are brightened and the separate points on them are observed. The raw details from the scanner is collected in the form of an Laser Scan Multiple. An LSM file consists each of the calculations from each profile observed by the camera **(Lee *et al.,* 2011).**

Manipulation of images to produce the reconstructed face

- **Systems and reconstruction software**

The facial reconstruction methods provides talent to observe a skull and face, position comparable landmarks on them and carried out a reconstruction using a predetermined set of tissue thicknesses. It has been planned to make the procedure of conducting a reconstruction based on encounter and see the results at the touch of a button.
The relevant features include:-

1. Rotate the objects in real time
2. View the objects from different direction
3. Recognizing the landmarks purely by moving the mouse pointer
4. Allow the operator to see where the skull landmarks
5. Able to collect faces with their facial landmarks

- **Landmark placement on skull**

After digitizing three dimensional skull image landmarks are then placed on the skull. Landmark is a set of tissue thicknesses gained from calculations. The soft tissue thicknesses are amounted as lines screening from the landmarks and length of the lines comparable to depth of the tissue at the respective location. The types of landmarks used are those for which facial thickness data is accessible. It is key element that the landmarks are location in their correct anatomical parts.

- **Selection of facial template from database and placement of facial landmarks**

The face has chosen which has quality average characteristics and similarised the skull anthropologically. Then located the landmarks. The number provide to each facial landmark is matching to number given to the skull landmark that will point after the reconstruction. The one-to-one depict is used to measure the mathematical measurements which will build the reconstructed face. When the operator is pleased that all the landmarks have been exactly placed then facial thickness data is choose to give either fat, medium or thin aspects to the face. The distance between the particular position of comparable landmarks on he skull and the face after the reconstruction has been conducted will be the tissue thickness chosen.

- **Production of the reconstructed face**

The computer is now ready to locate the face over the skull. The procedures includes moving every point on the actual face to a new position. A set of radial base functions is then gained and associate with the Procrustes again to give the final warp. The warp is then bear on to every point on the actual face provide the reconstructed face. Superimposition of the skull and the reconstructed face permits the operator to identify the soft tissue to skull alignment and to see if there are any apparent errors (www.epgp.inflibnet.ac.in).

- **Exporting the reconstructed face**

The methods gives the ease to sell overseas a 2D view from the 3D image in a TIFF or JPEG format. The file can then be bring into a police identikit system such as CD- fit or E-fit which permits the insertion of characteristics. Images can also be exported as VRML file format through the internet to allow distant sites

such as police stations and may be utilized for the manufacturing of a solid model such as a stereolithograph. An artist may also makes a sculpture of the reconstructed image working staright from the image on the computer monitor (**Lee *et al.,* 2011).**

Reconstructions are carried out through

Mass grave identification

Computerized facial reconstruction using too soon class of system has been worked in the recognition of victims killed by the Pinochet regime in Santiago, Chile in 1973. Fourteen skulls from a clandestine grave consisting 129 victims were reconstructed from plaster casts. The reconstructed images were beneficially matched with photographs of suspected victims and results concluded by superimposing skull casts with the photographs unconventionally by another laboratory. The author depend on the face shape controlled by the underscore skull to carry out the similarities. No dependence was located on the detail of individual facial facts such as eyebrows, opened eyes, lips and ears could not be forecast from the available data from the grave site (**Aulsebrook, 2000; www.britannica.com).**

Discussion

Three dimensional computer of profiling anatomy for characteristic, medical and educational purposes has been in alive for a number of years with the initiation of magnetic resonance imaging, computerized axial tomography and a number of other imaging techniques. The uses of such technology for facial reconstruction from skulls for the process of recognition was developed in the late 1980s. Facial reconstruction using three dimensional computer graphics was an unavoidable growth from the manual carving techniques with the entry of computer technology. The reconstruction manufactured should be worked as an aid to identification and not be consider under any facts as a ultimate means of determination. There are various factors that impact whether or not a reconstruction will lead to a determination

1. Issuing of the images needs to reach those who know the deceased
2. Relatives or any other friends who should know the deceased may for various reasons
3. The size of the population of missing persons is applicable to the success of identification
4. Knowledge of the dead person in the community

5. The person may have missed as a child and is not found dead until later adult life

6. The exactness of the reconstruction **(Lee *et al.,* 2011).**

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