**DAILY ASSESSMENT FORMAT**

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| **Date:** | **30-June-2020** | **Name:** | **Raziya Banu** |
| **Course:** | **Online Course through IIRS-ISRO E-CLASS** | **USN:** | **4AL16EC058** |
| **Topic:** | **Concepts of Stereophotogrammetry** | **Semester & Section:** | **8th sem & ‘B’ section** |
| **Github Repository:** |  |  |  |

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| **Image of session** |
| **Report –**  In my first session today I have studied about –Concepts of Stereophotogrammetry  **The use of 3D surface imaging technology is becoming increasingly common in craniofacial clinics and research centers. Due to fast capture speeds and ease of use, 3D digital stereophotogrammetry is quickly becoming the preferred facial surface imaging modality. These systems can serve as an unparalleled tool for craniofacial surgeons, proving an objective digital archive of the patient's face without exposure to radiation. Acquiring consistent high-quality 3D facial captures requires planning and knowledge of the limitations of these devices. Currently, there are few resources available to help new users of this technology with the challenges they will inevitably confront. To address this deficit, this report will highlight a number of common issues that can interfere with the 3D capture process and offer practical solutions to optimize image quality.** Introduction Methods that allow for the objective assessment of facial form are becoming increasingly important for research in dysmorphology, genetics, orthodontics and surgical disciplines among others. Such methods also have the potential to enhance clinical care by facilitating surgical planning, improving outcome assessment, and aiding in syndrome delineation. Non-contact 3D surface imaging systems are rapidly replacing traditional "hands-on" anthropometry as the preferred method for capturing quantitative information about the facial soft-tissues. These systems offer a number of distinct advantages: minimal invasiveness, quick capture speeds (often under one second), and the ability to archive images for subsequent analyses. In addition, a number of independent studies have demonstrated a high degree of precision and accuracy across a wide variety of 3D surface platforms The safety, speed and reliability of data acquisition that these systems offer are particularly helpful when working with young children, for whom quantification of facial features can be challenging .  The most common class of 3D surface imaging system is based on digital stereophotogrammetric technology. These systems are capable of accurately reproducing the surface geometry of the face, and map realistic color and texture data onto the geometric shape resulting in a lifelike rendering (Fig. [​(Fig.1).1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/figure/F1/)). The mathematical and optical engineering principles involved in the creation of 3D photogrammetric surface images have been thoroughly described [[16](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/#B16),[33](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/" \l "B33)-[35](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/#B35)]. The combination of fast acquisition speed and expanded surface coverage (up to 360 degrees) offer distinct advantages over older surface imaging modalities like laser scanning.  [[An external file that holds a picture, illustration, etc. Object name is 1746-160X-6-18-1.jpg](https://www.ncbi.nlm.nih.gov/core/lw/2.0/html/tileshop_pmc/tileshop_pmc_inline.html?title=Click%20on%20image%20to%20zoom&p=PMC3&id=2920242_1746-160X-6-18-1.jpg)](https://www.ncbi.nlm.nih.gov/core/lw/2.0/html/tileshop_pmc/tileshop_pmc_inline.html?title=Click%20on%20image%20to%20zoom&p=PMC3&id=2920242_1746-160X-6-18-1.jpg" \t "tileshopwindow)  [Figure 1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/figure/F1/)  **Example of a two-dimensional screen capture of a 3D facial surface model**The capture is alternatively rendered to show the underlying geometry, as well as color and texture information mapped onto the surface. Written consent for publication of this image was obtained from the participant's parent.  With decreasing cost, 3D stereophotogrammetric imaging systems are becoming increasingly common in clinical and research settings [[36](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/#B36),[37](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/" \l "B37)]. With any new technology, a number of factors must be considered in order to achieve optimal performance. Though camera manufacturers provide suggestions for device set up and calibration, limited information is available on the practical issues that will inevitably confront new users of this technology.  This report will serve to highlight a number of common issues that can interfere with the 3D facial capture process and will offer practical solutions and recommendations to optimize image quality. The Imaging EnvironmentLocation and placement When choosing a location to set up a 3D photogrammetry system, the most essential consideration is space. The minimum space requirements for a given system must account for the major components of the device, which typically include the imaging hardware, a tripod or other mounting system, a computer, a cart or table for the computer and a seat for the subject (Figs. [​(Figs.22](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/figure/F2/) and [​and3).3](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/figure/F3/)). The space must be adequate to accommodate: the physical footprint of the assembled imaging system, the computer that controls the imaging system, the subject and requisite seating, and pathways for the operator to move about unencumbered during the capture process  [[An external file that holds a picture, illustration, etc. Object name is 1746-160X-6-18-2.jpg](https://www.ncbi.nlm.nih.gov/core/lw/2.0/html/tileshop_pmc/tileshop_pmc_inline.html?title=Click%20on%20image%20to%20zoom&p=PMC3&id=2920242_1746-160X-6-18-2.jpg)](https://www.ncbi.nlm.nih.gov/core/lw/2.0/html/tileshop_pmc/tileshop_pmc_inline.html?title=Click%20on%20image%20to%20zoom&p=PMC3&id=2920242_1746-160X-6-18-2.jpg" \t "tileshopwindow)  [Figure 2](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/figure/F2/)  **Illustration showing example floor footprints for two different imaging set-ups**(A) 360 degree image capture system for imaging the entire head and face; (B) 160-180 degree image capture system designed to capture the face.  [[An external file that holds a picture, illustration, etc. Object name is 1746-160X-6-18-3.jpg](https://www.ncbi.nlm.nih.gov/core/lw/2.0/html/tileshop_pmc/tileshop_pmc_inline.html?title=Click%20on%20image%20to%20zoom&p=PMC3&id=2920242_1746-160X-6-18-3.jpg)](https://www.ncbi.nlm.nih.gov/core/lw/2.0/html/tileshop_pmc/tileshop_pmc_inline.html?title=Click%20on%20image%20to%20zoom&p=PMC3&id=2920242_1746-160X-6-18-3.jpg" \t "tileshopwindow)  [Figure 3](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/figure/F3/)  **An example of a 3D stereophotogrammetry system (3dMDcranial™ System) in a clinical research setting**The mechanical bed offers a safe surface upon which to secure a booster seat, while allowing the photographer to adjust the participant to ensure an optimal image capture.  Although practical concerns will often govern placement, factors such as availability of a reliable power source, access to internet and/or network ports, and the flow of foot traffic through the space (particularly if the system is in a public space) should be considered. It is also helpful for the operator to be able to view the computer screen during the capture process. Ambient lighting Different 3D photogrammetry systems have different ambient lighting requirements, but office lighting conditions (e.g. overhead fluorescents) are usually adequate. The adverse influence of suboptimal lighting typically occurs immediately preceding 3D capture, when the cameras display real-time video which allows the operator to adjust the position of the subject for optimal coverage. If the ambient light is too bright or dark, it may overwhelm the camera's sensors during this phase. During image capture, most systems are fairly robust to a range of ambient lighting conditions because they employ their own internal (or external) flash mechanisms [[16](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/#B16)]. However, excessive light may interfere with the system's flash units. This can occur when the system is set up adjacent to a large window with direct sunlight. If the system cannot be relocated, adjustable window blinds or shades can minimize the effects of sunlight. Installation options Permanent installation may be an option for some 3D systems. The advantages of permanent installation include: reduced wear-and-tear on the equipment, greater consistency in data collection and quality, and time savings. However, if mobility is required or dedicated space is not available, then the system may need to be assembled and disassembled as needed [[16](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/#B16)]. In this scenario, protective casing can ensure that the sensitive equipment can be stored and transported safely. Hard cases equipped with customizable high-density foam offer such protection. Seating options A variety of seating options will work well for most 3D surface imaging environments. Two criteria to consider include: (1) the ability to adjust the seat's vertical height to accommodate subjects of varying heights and (2) back support to keep subjects in the correct posture. For investigators using a 360-degree view system, it is important to ensure that the chair's back height does not interfere with the image acquisition from rear cameras. For systems where the subject must be positioned to fit within a narrow imaging window, casters allow for multidirectional mobility on most surfaces. Newer digital stereophotogrammetry systems have fast capture speeds that obviate the need for head restraint. Safety and security precautions The 3D imaging environment presents some physical obstacles to subjects and operators. The cables and cords that connect the imaging components, particularly cables that traverse areas of foot traffic, should be bundled. Taping cables to the floor prevents tripping. Tripod legs can also pose a tripping hazard. Allotting enough room to provide an unobstructed route through the imaging environment is essential for participant safety and to avoid the need for recalibration if the camera system is disrupted.  [Go to:](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/) Maximizing Image QualityReducing artifacts Most digital stereophotogrammetry systems have difficulty capturing hair, which can result in a substantial loss of surface data on the head and face (Figs. [​(Figs.44](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/figure/F4/) and [​and5).5](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/figure/F5/)). The forehead and the ears are the regions most vulnerable to interference from scalp hair [[16](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/#B16)]. Pins, barrettes and hairbands can be effective when used either alone or in combination [[24](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/#B24),[39](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/" \l "B39),[40](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2920242/#B40)]. Snug fitting wig caps work well; however, care must be taken to avoid placing excess tension on the skin, which can alter the facial surface . |