Digital Specimen 2014

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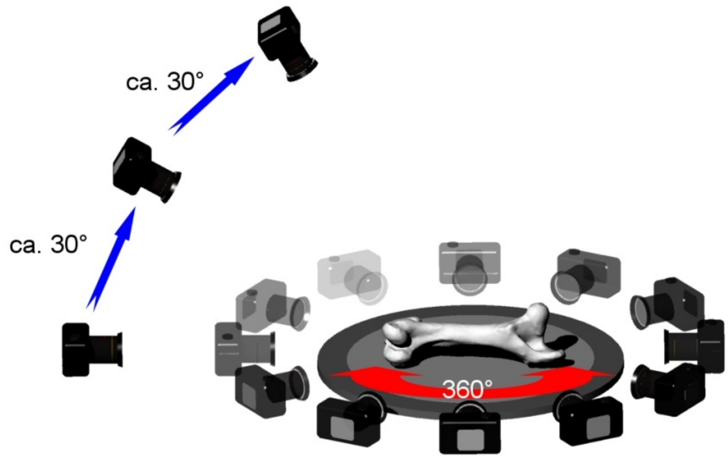
Abstracts of Presentation



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Digital Specimen 2014 - Abstracts of Presentations

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Wax apples, life flowers and hummingbird: limitations in the creation of digital 3D images for specimens. Examples from Naturkundemuseum Bamberg, Germany and Grant Museum of Zoology, UCL, London.

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This presentation will be an honest appraisal of 3D imaging programmes for a diverse range of zoological specimens. Other studies have compared different technologies according to time, cost and sensor resolution (Mathys et al., 2013). This presentation would like to deal with expectation management, and flag arising difficulties for 3D imaging planning before 3D recording.

Three dimensional surface imaging of specimens can be motivated by a research approach - for example by the need for morphometric and colorimetric surface data for comparative anatomy and zoology - or by creating a digital resource and sometimes physical replica - for education, teaching and outreach.

As ambitious and wide ranging these projects are, some of the specimens present in natural history museums have proven to be difficult optical surface 3D digitization. The optimal surface for 3D imaging is 1) lambertian, which means diffusely reflecting (for example sandstone) and 2) ideally with a limited amount of surface complexity without undercuts or occluded areas. The rule of thumb for assessing if a specimen can be 3D imaged by optical means is: if it is difficult to photograph due to gloss (e.g. specularity), transparency or refraction of liquid, then it will be difficult to create a 3D image.

The following case studies represent the 'difficult cases'. These specimen and objects have been 3D imaged with different technologies fully expecting that they were going to be difficult or even fail. The imaging results will be demonstrated in 3D.

1. Glossy surface without any surface features. In 2005 the Naturkundemuseum Bamberg aimed to digitize their very rare collection of wax fruits, many of which represent extinct species and varieties. The 3D imaging was achieved with a Steinbichler Comet and a turntable, colour was applied through texture mapping multiple photographs onto the surface but the connection between 3D surface geometry and 2D picture proved impossible in the round (Figure 1 and Figure 2). **2.** Fur and feathers. A squirrel monkey was digitized with a 3D colour laser scanner. As the spot sized of the laser scanner exceeds the diameter of hairs the fur surface of the monkey was physically impossible to capture.(Figure 3 and Figure 4)**3.** Fluid preserved specimens in jars. This trial used 3D colour laser scanning to see if any surface could be captured. As the refraction index of both the glass and the spirit impedes a clear line of sight to be able to compute the triangulation, this specimen could not be imaged.**4.** Fragile transparent object. The Grant Museum has a collection of Blaschka and represent a remarkable realization of creating models of marine invertebrae. (Carnall and UCL Grant Museum of Zoology, 2014). While opaque painted areas were relatively easy to 3D image, the more transparent and translucent tentacles for example were very difficult to capture and to process. **5.** Iridescent kingfisher. This specimen proved to be partly 3D image-able where it was opaque, e.g. the beak. The iridescent feathers were difficult to image due to overexposure when reflecting back into the optics, and when moving the object around every feather came to lie in a small but discernibly different position, which made alignment difficult.**6.** Live flowers. To image live specimens, such as flowers, it will be necessary to use photography based, or other full sensor based technologies (such as fringe projection, or range cameras) to capture the object quickly. The trial with a 3D laser line scanner was very slow and the wilting of the flower during the session did not allow a correct registration.

While there are possibilities to coat transparent and glossy specimen with spray (conservation safe option is available, but product not disclosed here) to make them compatible for 3D optical surface imaging, some specimens prove impossible to 3D image. Other technologies, such as CT (Computer tomography), X-ray, RTI (Reflection Transformation Imaging) or holographic recording might yield a more successful imaging result to be fit-for-purpose.The 3D imaging projects conducted at the Grant Museum of Zoology did not only include difficult specimens, but there were also very successful and compelling 3D imaging outcomes for the following cases: a gypsum cast of the head and foot of a Dodo (Nicholls, 2012), an elephant tooth (slight problems with reflecting enamel but still possible to image), sea horses, a sea urchin (but difficulty with the amount of detail for typifying it), and the documentation of a very well preserved cast of the Archaeopteryx from Solnhofen (in better condition than the cast at the British Museum) (Archaeopteryx lithographica, Grant Museum of Zoology. 3D colour laser scan., 2013), (3D scans at the Grant Museum, 2013). These objects can be seen in 3D on the Youtube link: http://youtu.be/nFj6eDw21Ec and here http://youtu.be/uj3Jrmy-hDI.A further example of a successful project typifying fossils and making a 3D image library available online is the GB3D type Fossil (JISC GB3D Type Fossils Online Project partners et al., 2013).

Some of the desirables to solve for research-grade 3D imaging next to quality controlled 3D imaging of specimens in museums are:
• ownership of the data by external researcher,
• accessibility of data for the curator and conservator through a server,
• no proprietary software to display and research 3D models,
• option for dynamic annotation on the model for labelling,
• a web-based 3D imaging database,
• and finally sustainable long-term data storage.

While some of these issues have been addressed with customized user interfaces by projects such as the newly released 3DPetrie Online Image Database (3D Petrie, 2014), an easy solution for the curator, who might not have administrative rights on their computer, has not yet been offered. In the current wave of democratizing and crowdsourcing 3D imaging we hope that solutions will can be offered, so that also small low cost collections will be able to produce their own Digital Specimens.

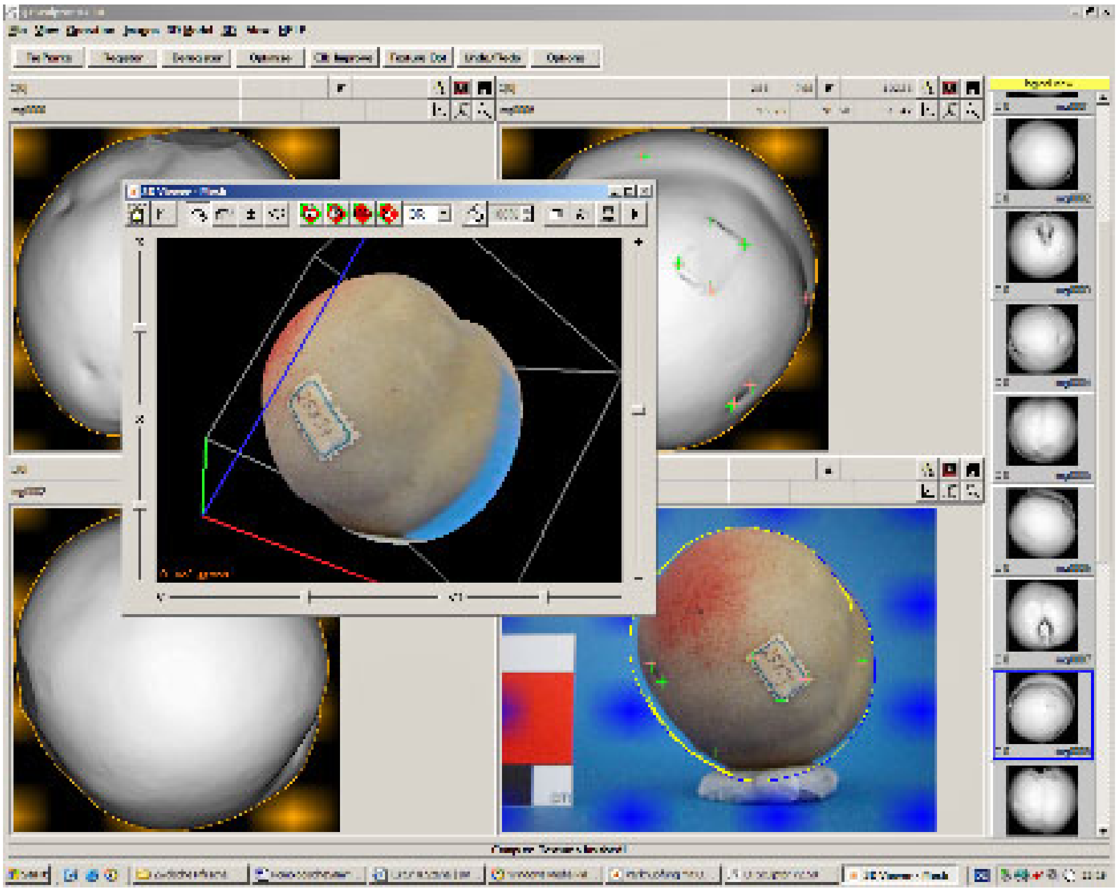

Figure 1. Textured object from 3D model and photographs Software QT Sculptor. (“Aprikose von Nancy”, Bamberg Naturkundemuseum), Mona Hess, 2005.

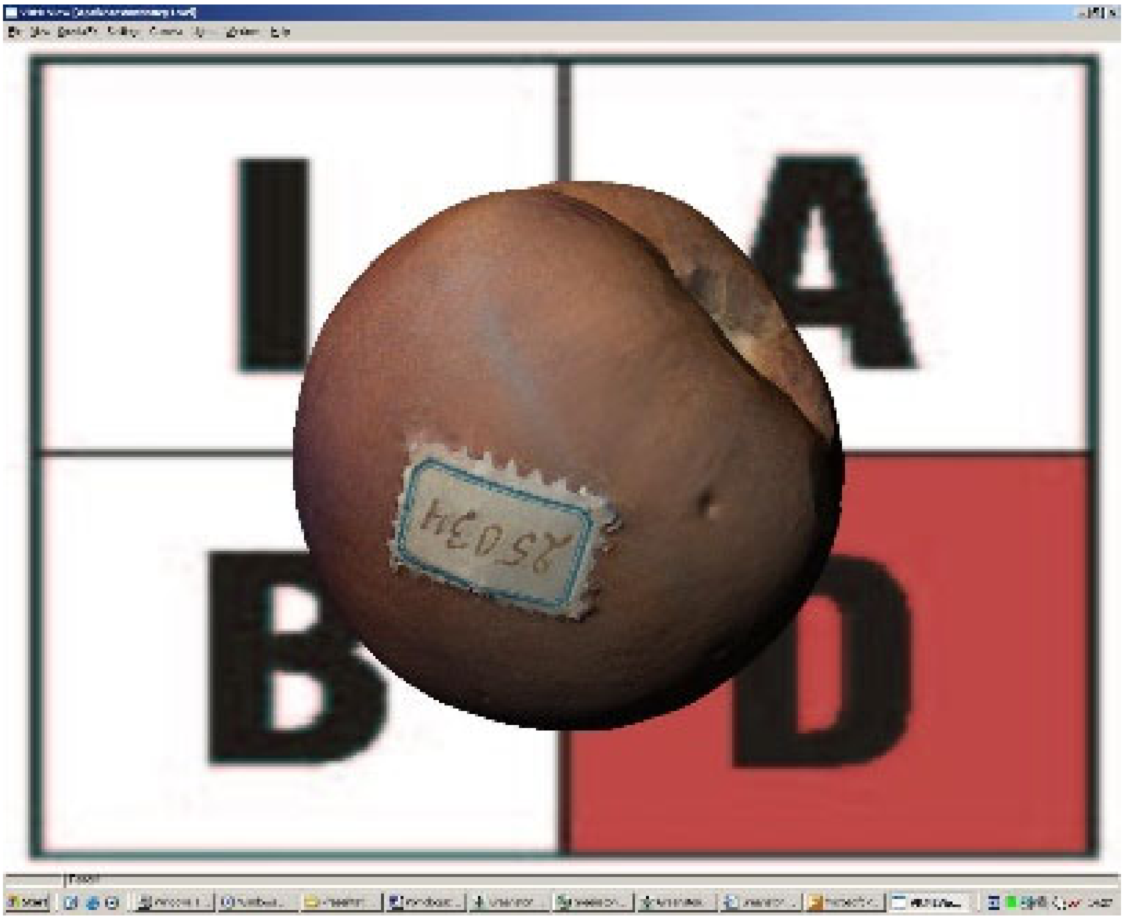

Figure 2. Textured 3D object. (“Aprikose von Nancy”, Bamberg Naturkundemuseum),Mona Hess, 2005.

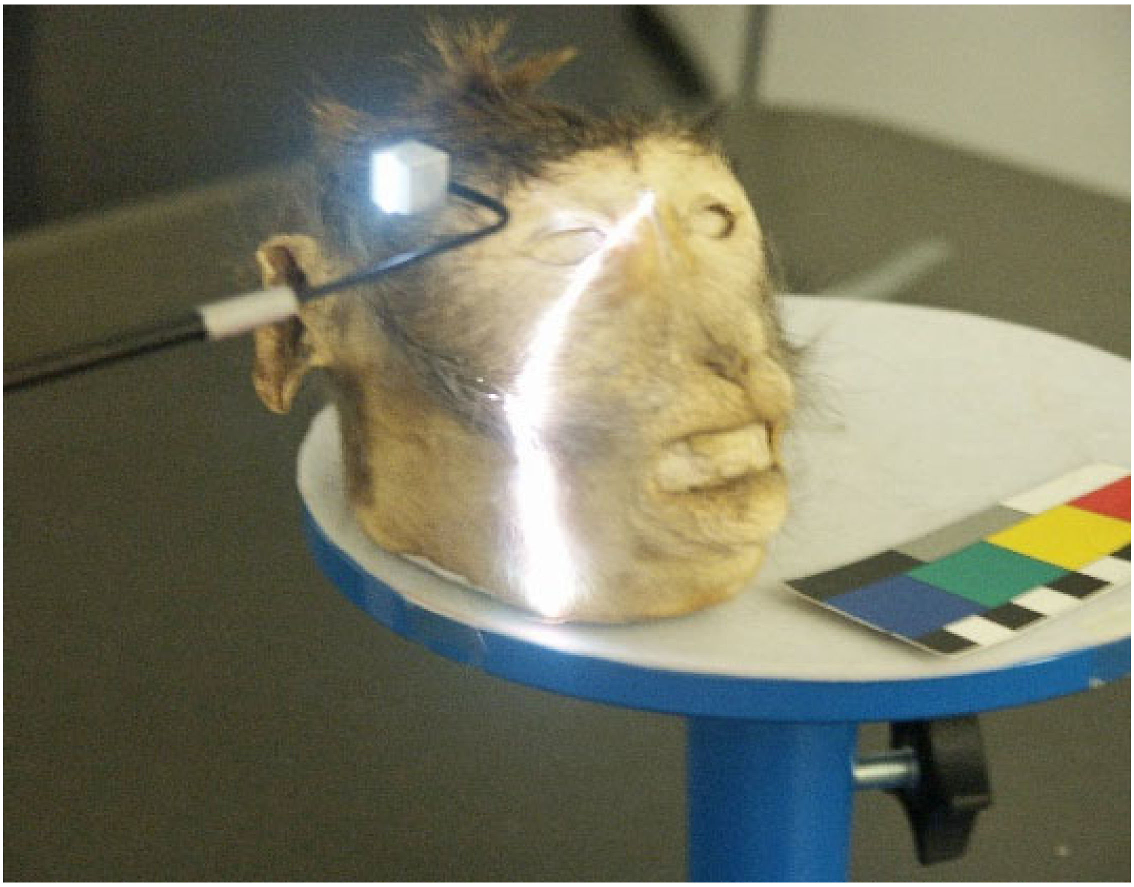

Figure 3. 3D colour laser scan of a Squirrel monkey (Grant Museum of Zoology). Mona Hess. 2009.

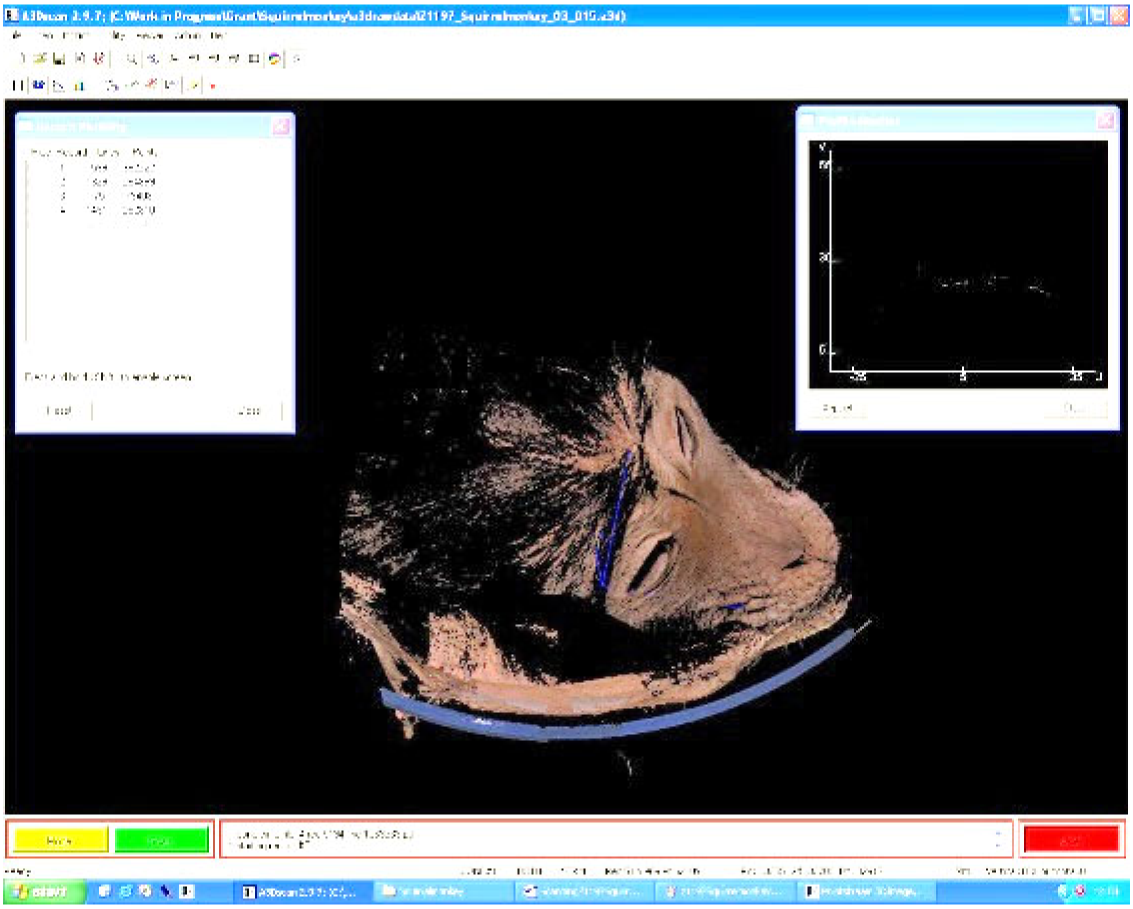

Figure 4. Outcome 3D colour laser scan of a Squirrel monkey with most of the head missing due to hair (Grant Museum of Zoology). Mona Hess. 2009.

Figure 4. Outcome 3D colour laser scan of a Squirrel monkey with most of the head missing due to hair (Grant Museum of Zoology). Mona Hess. 2009.

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