Pacific Graphics Conference
&
Indigenous Heritage Site Recording

Pacific Graphics: Hong Kong, 12-14 September 2012

Heritage recording: Cape Lambert, 6-7 September 2012

Paul Bourke

iVEC @UWA

Introduction

- "Pacific Graphics (PG) is an annual international conference on computer graphics and applications. As a highly successful series, Pacific Graphics provides a premier forum for researchers, developers, practitioners in the Pacific Rim and around the world to present and discuss new problems, solutions, and technologies in computer graphics and related areas."

- Started in 1993 in Seoul, has been held every year since rotating around various cities in the Asia-Pacific region.

- Small compared to Siggraph Asia, about 130 registrants.
  Single stream so typically 80-100 per session.

- Papers for the 2012 conference can be found online at
  http://www.cse.ust.hk/~psander/pg2012proc/pg/index.html

Papers

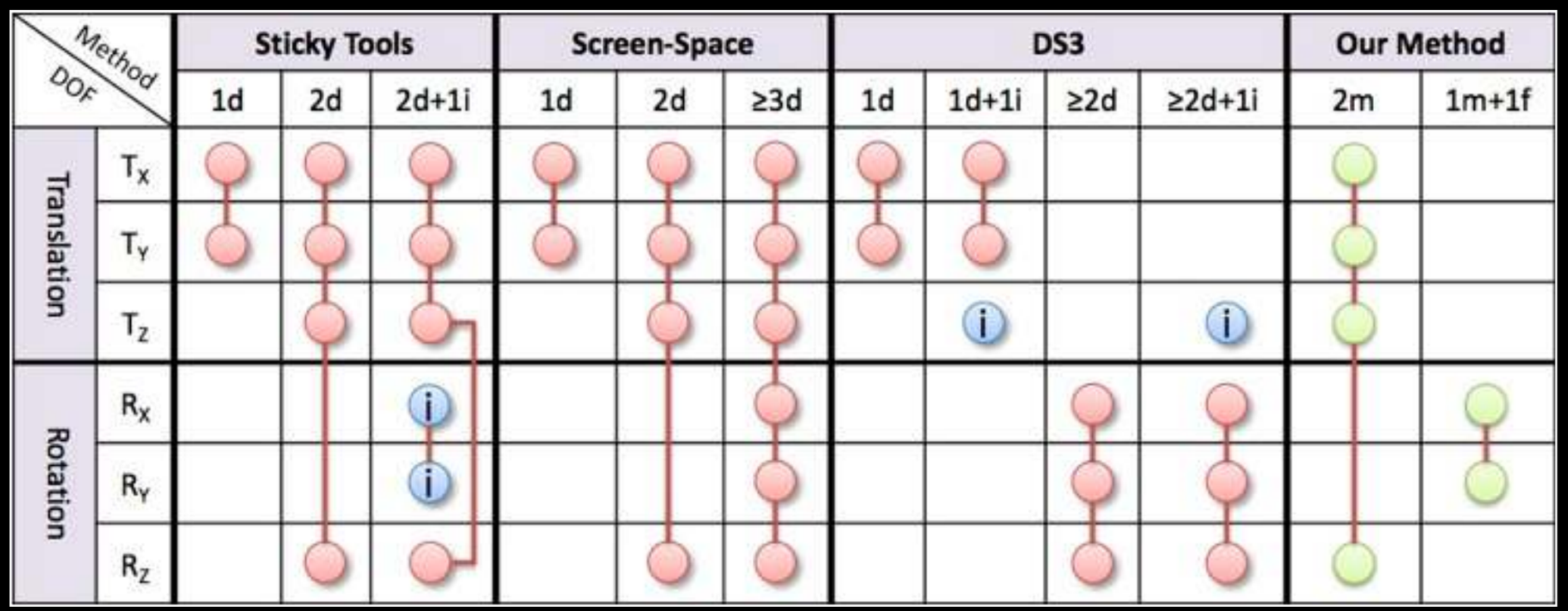
- Usual range of technical papers: computational geometry, GPU algorithms, special effects, rendering, image processing, ...

- Session themes this year
  - Imaging and hair
  - Animation and interaction
  - Geometry processing
  - Applied geometry for graphics and simulation
  - Image editing and processing
  - Shape processing and modeling
  - Rendering systems and techniques

- 3 papers on remeshing and mesh simplification that are directly relevant to work I'm doing in mesh reconstruction and decimation, see later applications to archaeology.

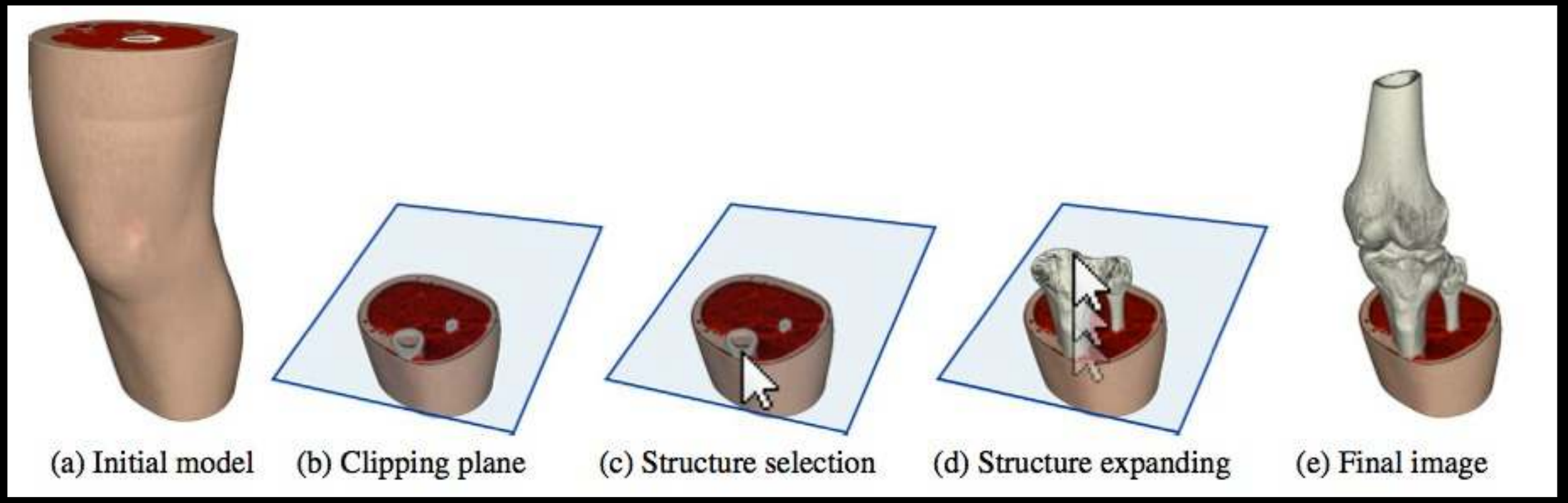
Two finger 6DOF manipulation of 3D objects

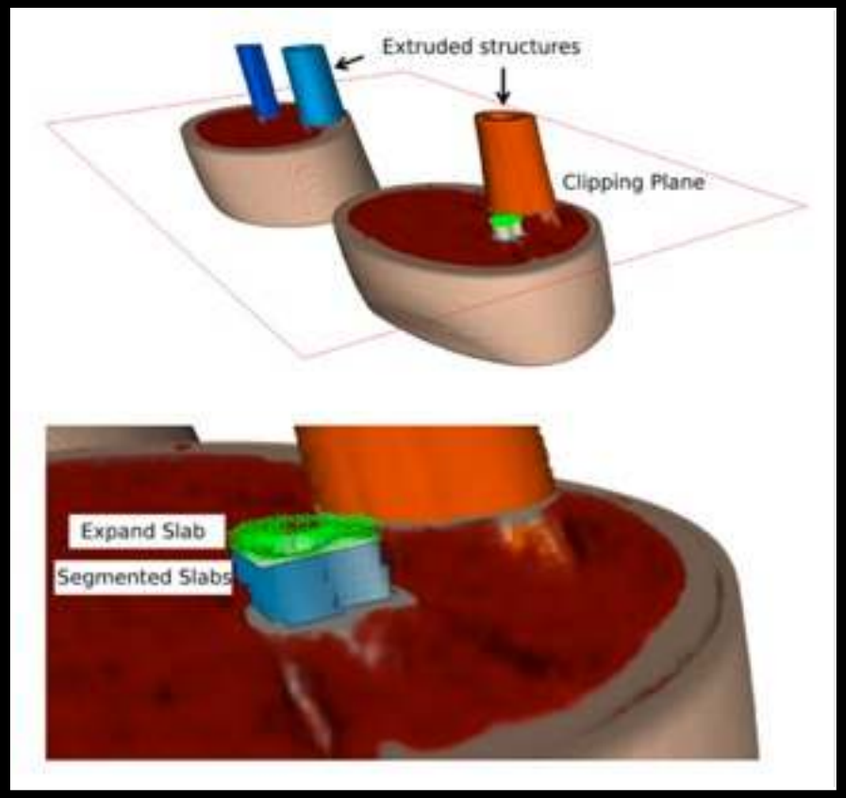
- Authors: Jingo Liu, Oscar Kin-Chung Au, Hongbo Fu, Chiew-Lan Tai
  Hong Kong University of Science and Technology, City University of Hong Kong
- Targeting the manipulation of 3D objects on a small screen (eg: mobile devices).
- Limited screen real estate for large numbers of fingers and still able to see the display.
- Solution: Always uses two fingers, gets extra degrees by considering relative movement of the fingers. "m" = movement, "f" = fixed.

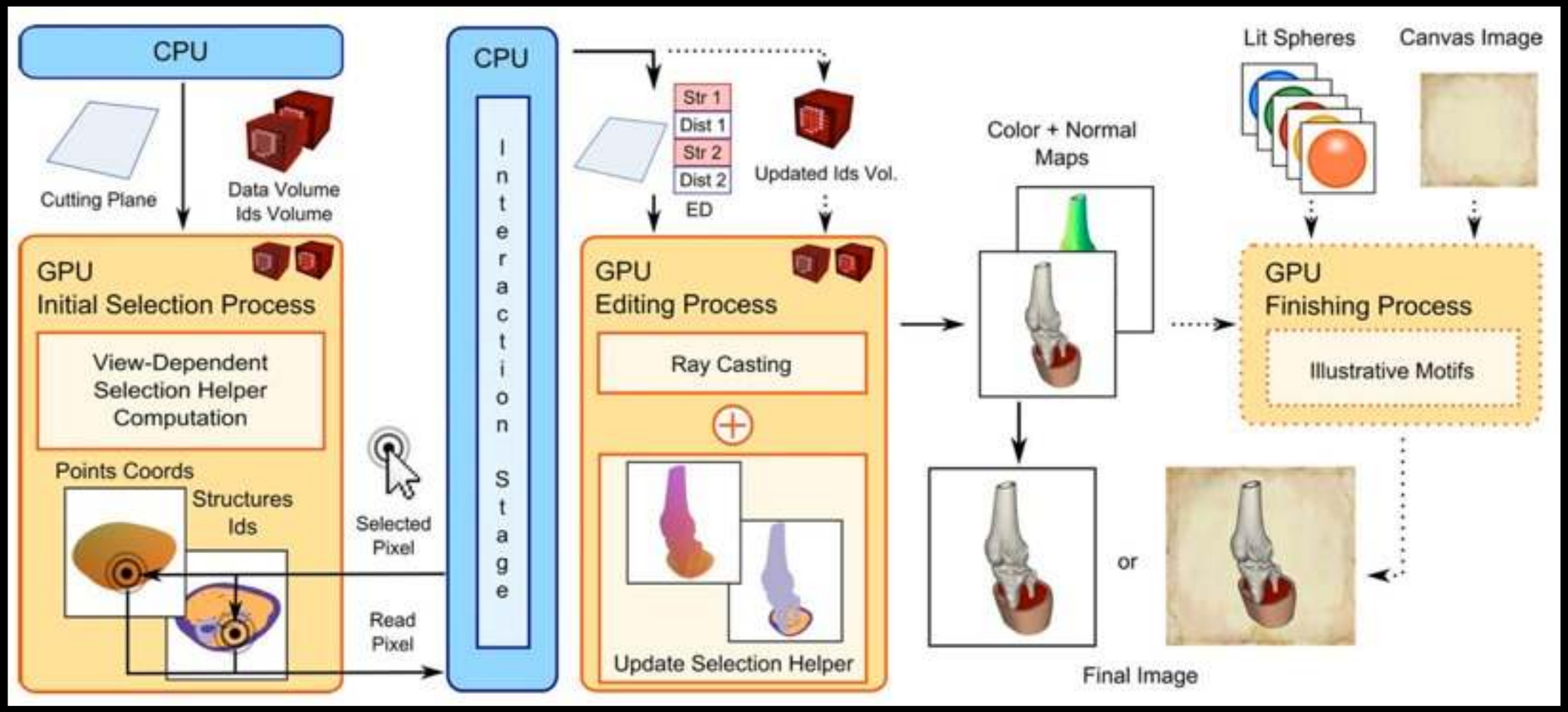


Adaptive Cross-sections of Anatomical Models

- Authors: Jose Díaz, Eva Monclús, Isabel Navazo, and Pere-Pau Vázquez
  MOVING Research Group, Universitat Politecnina de Catalunya, Barcelona, Spain.
- Interactive extraction of internal structures from cross sections of volumetric data.
- Cross sections clip all structures equally, here internal isolevels or preclassified data is "pulled" out of the cross section.
- Targeted at medical applications.




Extruded structures
Clipping Plane
Expand Slab
Segmented Slabs


CPU
Cutting Plane
Data Volume
Ids Volume
GPU
Initial Selection Process
View-Dependent
Selection Helper
Computation
Points Coords
Structures
Ids
Selected
Pixel
Read
Pixel
CPU
Interaction Stage
Str 1
Dist 1
Str 2
Dist 2
ED
Updated Ids Vol.
GPU
Editing Process
Ray Casting
Update Selection Helper
Color + Normal
Maps
Lit Spheres
Canvas Image
GPU
Finishing Process
Illustrative Motifs
or
Final Image

Homunculus Warping

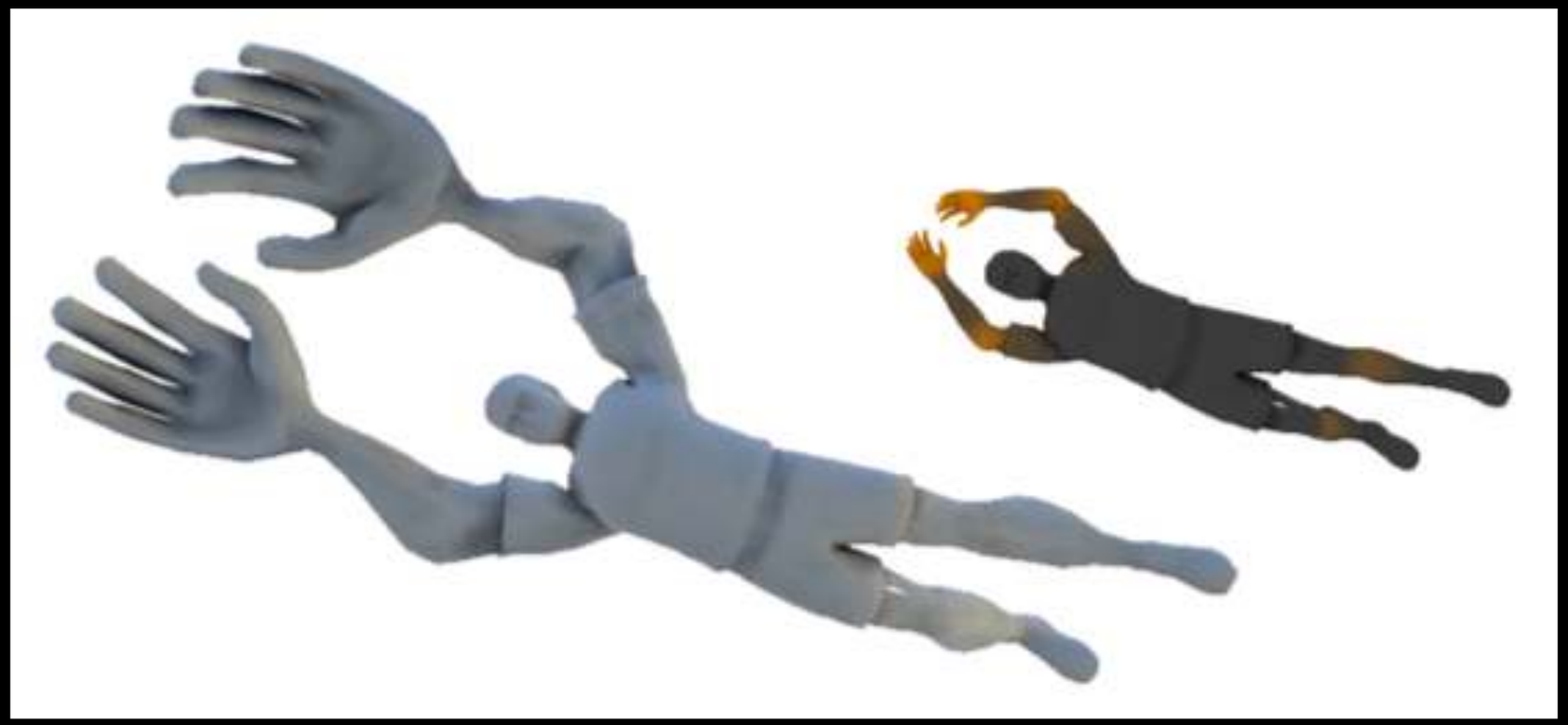
- Authors: Bernhard Reinert, Tobias Ritschel, and Hans-Peter Seidel
  MPI Informatik, Germany

- Conveying importance using self-intersection-free non-homogeneous mesh deformation.

- Visualising geometric data where the importance of a feature is mapped to the size.

- Example is representation of neural density in the human body.

- Subject of the paper was twofold: an interactive tool for assigning relative importance; how to locally scale the mesh without causing intersections.



http://www.youtube.com/watch?v=T5pytY3OL_0&feature=channel&list=UL

Digital Camouflage Images

- Authors: Hui Du1, Xiaogang Jin, Xiaoyang Mao
  State Key Lab of CAD&CG, Zhejiang University, China, Zhejiang University of Media and Communications, China, University of Yamanashi, Japan

- "We modify the large-scale layer of the background image by considering structural importance based on energy optimization and the detail layer by controlling its spatial variation. A gradient correction is presented to prevent halo artifacts. Users can control the difficulty level of perceiving the camouflage effect through a few parameters. Our camouflage images are natural and have less long coherent edges in the hidden region. Experimental results show that our algorithm yields visually pleasing camouflage images."






Vertex quantisation

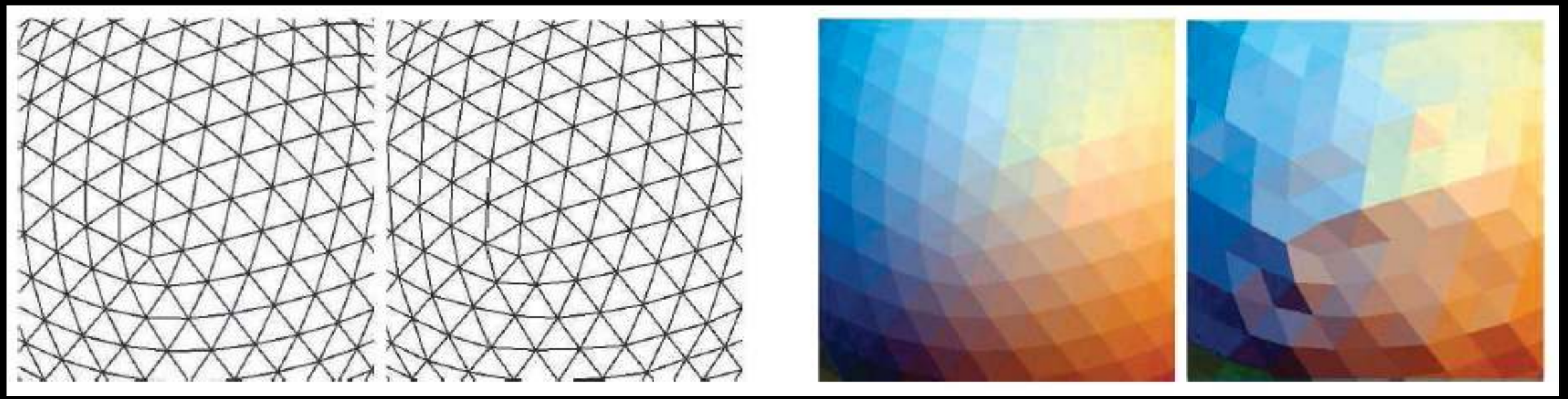
- Authors: Ying Yang, Norbert Peyerimhoff and Ioannis Ivrissimtzis
  Durham University

- Familiar with quantisation of RGB colour (8 bits per component) and the consequences.

- Less familiar with the effects of quantisation on the vertices of a 3D mesh.
  Can change appearance in two ways, directly and indirectly (change of normal).
  The later is generally going to create a noticeable degradation before the former.

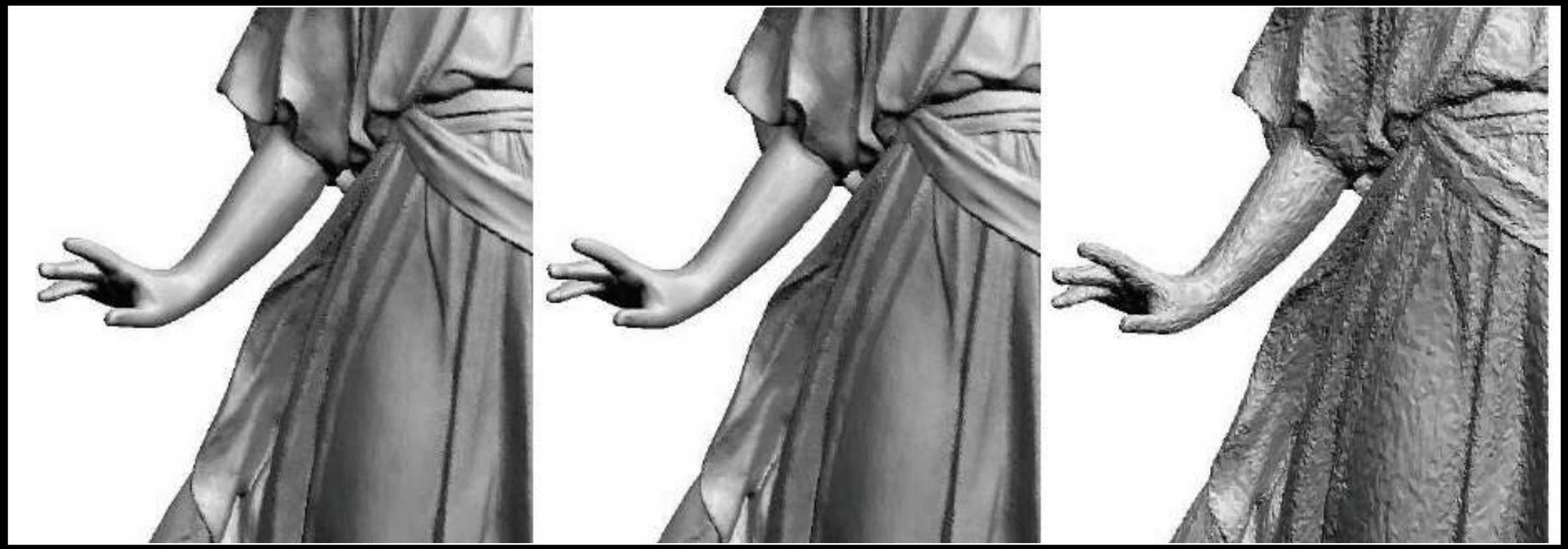
- Interested in quantifying the degree of noise and/or quantisation that can be added before it is noticeable.

- Applications in mesh compression and data hiding (Steganography) and watermarking.



The challenge in designing a good data hiding algorithm lies in balancing two conflicting requirements: high embedding capacity and low embedding distortion.

Normal degradation tolerance (their metric): 0.1, 1, 10



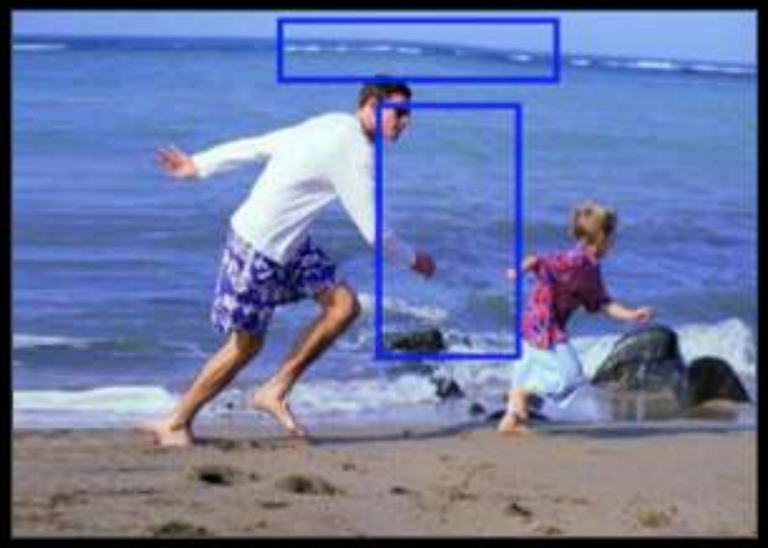
Need a metric that is independent of the characteristics of the mesh.
For example, mesh density and range of sizes of elements (triangles) of the mesh.

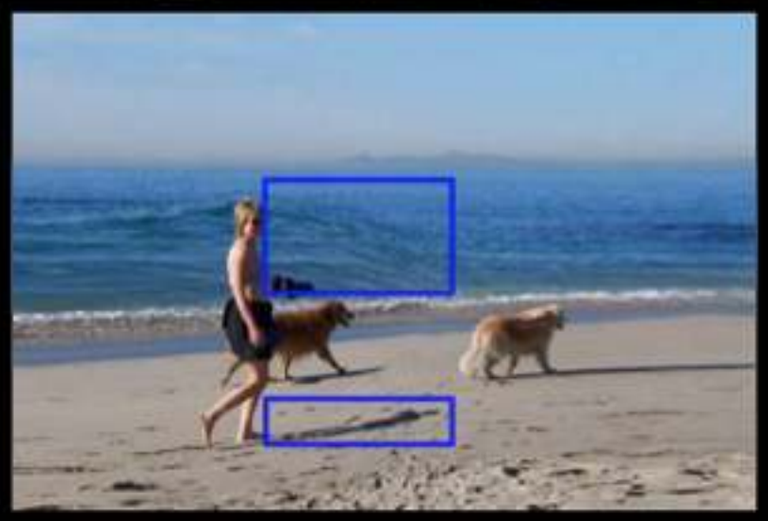
Improving Photo Composition Elegantly

- Authors: Y. W. Guo1, M. Liu, T. T. Gu, and W. P. Wang
  National Key Lab for Novel Software Technology, Nanjing University, Department of Computer Science, The University of Hong Kong

- Similar to work being done to rescale images to support different display resolutions and aspect ratios while retaining key elements.

- "Our method computes an improved image using a unified model of composition aesthetics and image similarity. The term of composition aesthetics obeys the rule of thirds and aims to enhance image composition. The similarity term in contrast penalises image difference and distortion caused by composition adjustment."


Heritage site recording

A project in conjunction with Jo McDonald (Director)
Centre for Rock Art Research and Management

Location: Rio Tinto ship loader facility, Cape Lambert

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Introduction

- Second project following an earlier test of the technology at a rock art site near Newman, presented previously.

- Unlike the earlier exercise this was more "serious", the site will be redeveloped within weeks of the survey ... we only get one chance.

- Funded by Rio Tinto who are widening the railway system to the iron ore ship loaded at Cape Lambert.

- Rock art by the Ngarluma Aboriginal people.

ANTHROPOS AUSTRALIS

NGARLUMA
ABORIGINAL CORPORATION

context

Cape Lambert

Cape Lambert

Cape Lambert

Recordings

- Archaeological recordings (Jo McDonald)
  - Close photographs or artwork
  - Dimensions
  - Position (Differential GPS, 10cm accuracy), facing direction
  - Interpretation notes

- My responsibilities
  - Site wide recording at high fidelity (GigaPixel)
  - Capture of ground based bubbles (Equirectangular projections)
  - 3D reconstructions of individual rocks and artworks

- Outcome will be a database of the site at various resolution scales and a visual interface to both imagery, 3D models, and meta data.

Traditional data capture

Panel 1 (512858mE 7714203mN)

Panel 1, Motif 1:

Aspect:	North
Technique:	Pecked
Style:	In filled
Form:	Enigmatic
Clarity:	High
Weathering:	Low
Salvageability:	Medium
Boulder Size (mm):	590 x 380 x 330
Motif Size (mm):	120 x 110
Location of Panels:	Small rock outcrop (rock pile)
Lithology:	Basalt
Disturbance (%):	10
Erosion:	Low
Rock and Motif Colour:	Brown/Light

Plate 19: Close up of Panel 1
Motif 1 within Aboriginal site CL3-12-02 (scale =10 cm)

Gigapixel site capture

- Proved to be problematic.

- Safety constraints from Rio Tinto did not allow a platform for a high viewing position.
  Not allowed to be standing on a platform more than 1.8m high.

- The interesting part of the site is the top of a rock mound, images from the lower sides are of little interest.

- As such, gigapixel images were difficult
  - from the top the ground falls away on all sides
  - there is a large depth involved resulting in focus issues, even with tiny apertures

- 2 examples at http://gigapan.com, search for “Cape Lambert”

90 photographs

40,000 pixels across

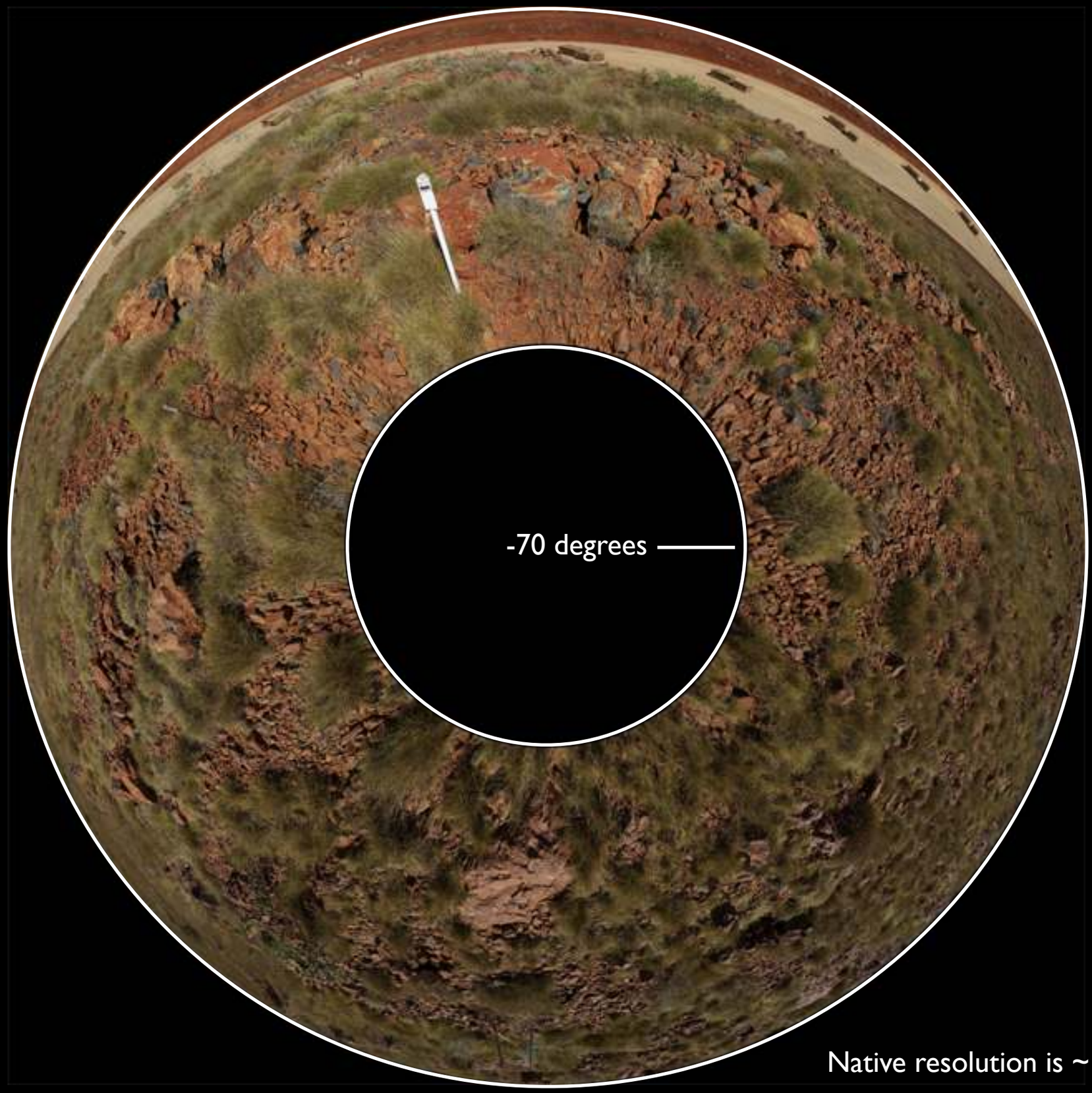
“Down pointing” gigapixel scans

- Most panoramas are symmetric about the horizon, as per last example.
- Here we are more interested in the land.
- Arranged a 1.4m high platform + 1.2m tripod to capture down pointing panoramas.
  Had hoped to get a much taller “cherry picker”.
- Capture approximately -70 to -15 degrees in latitude.
- Very unnatural looking when arranged as a panorama.

-15°

-70°

Circular views - section of sphere around camera



Native resolution is ~ 25,000 x 25,000

Ground based bubbles

- Capture of 360 x 180 degree panoramas is hardly new.
- With the right equipment and software the process is much easier and has a lower risk of blending errors.
- Equipment: Canon 5D MkII SLR and Canon 8-15mm fisheye lens.
- Captured 36 bubbles in total, arranged in a semiregular sampling of the site.
  Will form the basis of a virtual tour and link to other meta data.
- About 5 minutes per bubble, mostly spent levelling tripod on a very uneven surface.



Final equirectangular projection

Demonstration of interactive view, bubble 33

What happened to the tripod?

Often holes in the sky

Tripod legs and photographers shadow

3D capture of rocks and artwork

- Previous exercise typically employed between 3 and 12 photographs per rock art.
  Most examples were on cliff faces so really only 2.5D facades.

- In this example many rocks were elevated so need to capture more complete 3D models.

- Captured between 10 to 30 images per object.
  Used a fixed focal length lens, general requirement for the reconstruction.
  Performed lens calibration for PhotoModeller Scanner software.

- Main constraint was access.
  - One side of the mound was a cliff to the existing railway.
  - Terrain is very rough so 360 degree access around a rock was not always possible.

- Another issue was the tall grass (Spinifex) blowing in a strong wind on the second day.
  Not necessarily easy to clear.

- Needed to capture objects when sun is not causing strong shadow regions on the rock.
  Most relevant for high standing rocks, the shadows are baked in introducing photographic complexities.

- 36 rocks captured. Originally only 17 planned but they kept finding new art!

Example

- Rock art in this exercise was somewhat more subtle than the first exercise at Newman.
- Many were just "scratching" of the rock.

Example (24 photographs)










Example showing images (Rock 6)

Example

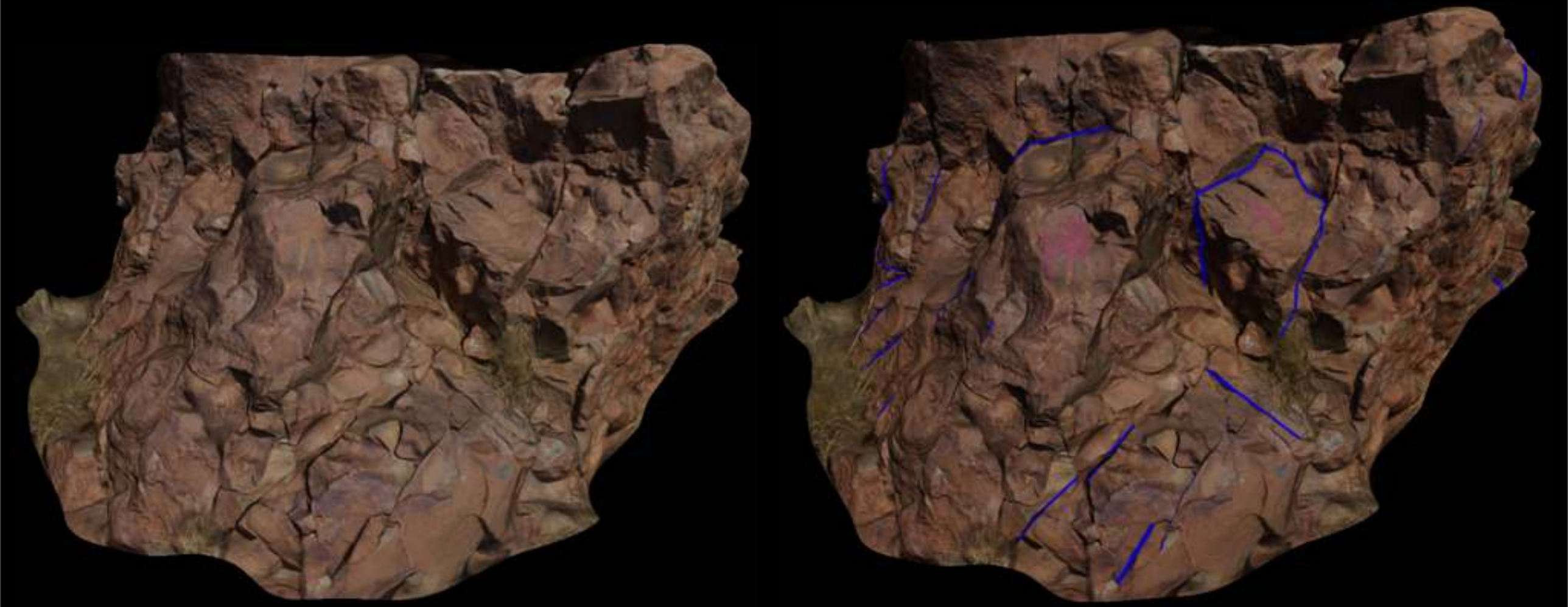
Baked on shadows

24 images

MIssing textures
[Out of any camera view]

Demonstration of mesh example (Rock 19)

Annotations



Demonstration of simple annotation example (Rock 31)

Exporting Australia

Extremes

Dampier

Hong Kong

Extremes

Donga, Dampier

Langham, Hong Kong